Power Engineering

JUNE 1952

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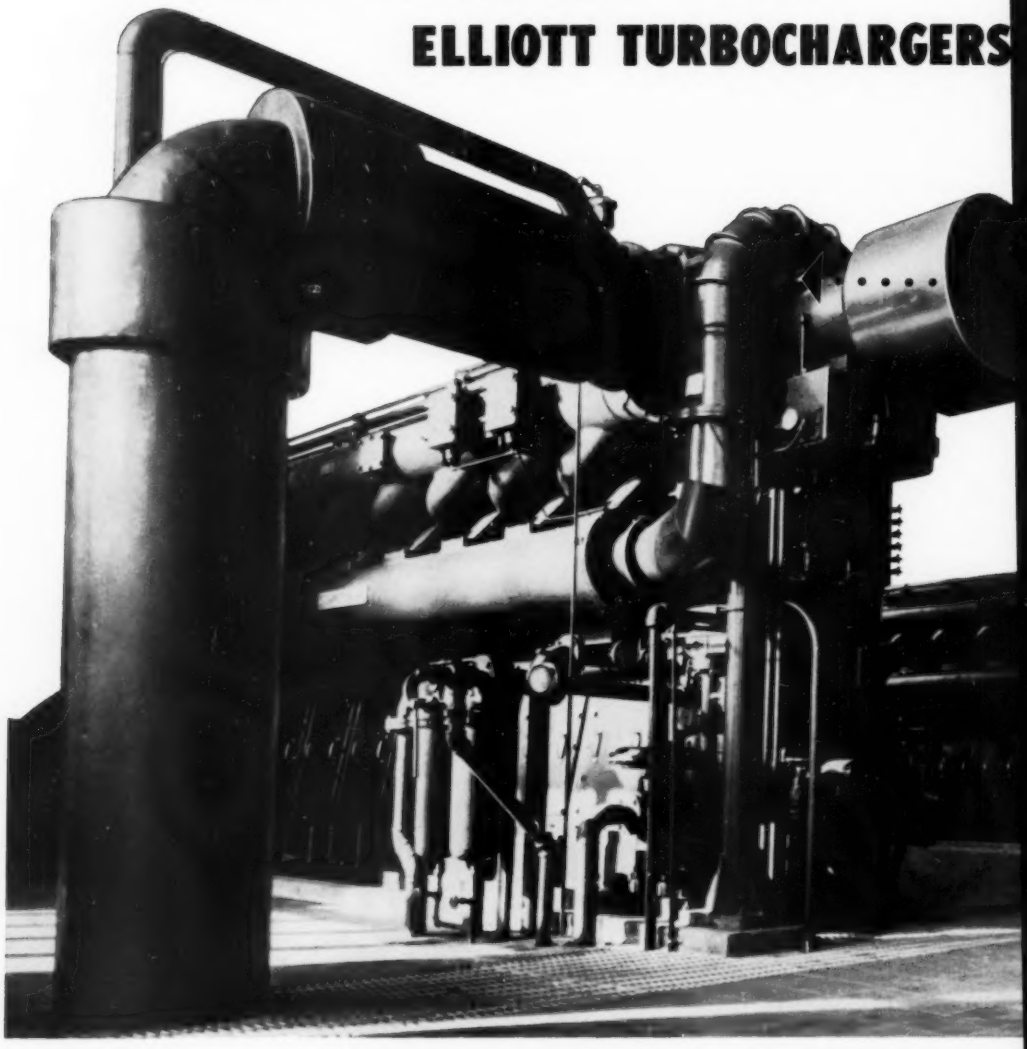
TECHNICAL PUBLISHING COMPANY CHICAGO, ILLINOIS

Diesel economy

The six dual-fuel diesels in New York's new sewage treatment plant, are equipped with...

ELLIOTT TURBOCHARGERS



begins here

● Designed for the ultimate in operating economy, the new beautifully appointed Owl's Head (New York City) sewage treatment station utilizes by-product sewage gas for diesel fuel, plus oil as needed only when pumping conditions impose peak loads, as in the case of heavy rainfall.

To further insure maximum savings the advantages of Elliott turbochargers are realized to the full, in their application to each engine. These advantages, as demonstrated in many hundreds of installations, include:

- Engine output increased up to 100%
- Increased overload capacity
- Constant torque at reduced speeds
- Reduced consumption of fuel and lube oil
- Turbocharger operation unaffected by reversing engine.

THE LATEST DEVELOPMENT IN TURBOCHARGING is the Elliott high-pressure type, illustrated above, for blower pressures to 20 psi, permitting 170 bmep (and more) in the cylinders. Built in sizes for four-cycle engines up to 3500 hp.

For full data phone or write your nearest Elliott district office.

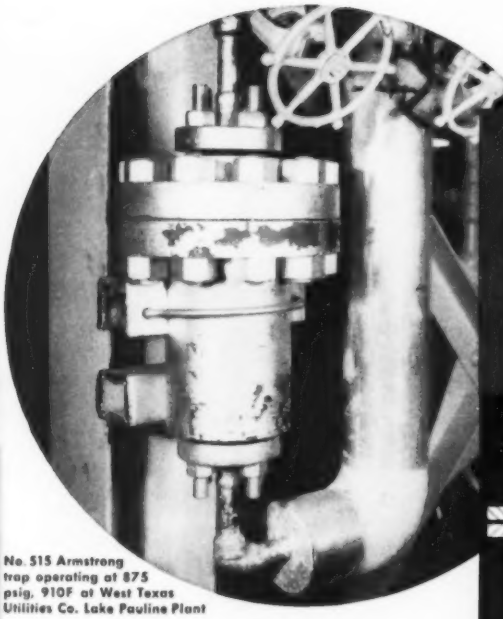
ELLIOTT Company

Supercharger Dept., Jeannette, Pa.

PLANTS AT: JEANNETTE, PA. • RIDGWAY, PA.
AMPERE, N. J. • SPRINGFIELD, O. • NEWARK, N. J.
DISTRICT OFFICES IN PRINCIPAL CITIES

Engine room of the Owl's Head Station, designed for maximum operating economy. Features six Superior 1300-hp, 327-rpm, 8-cylinder dual-fuel diesels, equipped with Elliott turbochargers.

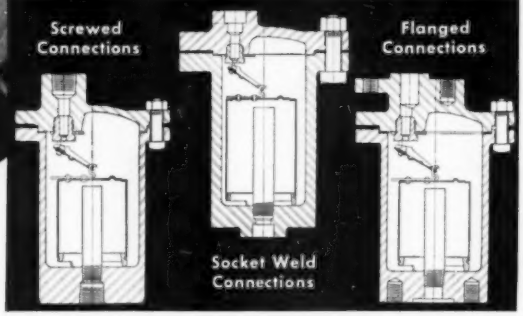
M3-2



No. 515 Armstrong trap operating at 875 psig, 910F at West Texas Utilities Co. Lake Pauline Plant

FOR HIGH PRESSURE CONDENSATE DRAINAGE...

(UP TO 2400 LBS.)*



...it pays to use

ARMSTRONG FORGED STEEL STEAM TRAPS!

Because:

1. *They provide dependable automatic drainage* of condensate and boiler carryover for protection of valves, turbines and other equipment.

2. *They have been thoroughly proved* in use in important power plants all over the world.

3. *Armstrong has built thousands of them* since 1929 and has the experience necessary to insure safe design and application. In fact, Armstrong pioneered the development and application of traps for high pressures and has continuously kept pace with the trend to higher pressure plants.

4. *Generous margins of safety are provided,* not only in the forged bodies and caps, but in the power provided for opening the valve and in bucket buoyancy for closing the valve. There is no steam waste and no failure to open.

5. *The quality is unsurpassed*—chrome steel valve and seat are hardened, ground and lapped; other working parts are stainless; bodies, caps and bolts and nuts are of materials approved for pressures involved.

6. *The cost is moderate*—first cost because of quantity production, long run cost because of low maintenance.

7. *They are guaranteed to give complete satisfaction.* Your local Armstrong Representative is fully qualified to discuss your forged steel trap applications and to answer your questions. Give him a call, or write:

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* Many plants, particularly refineries and chemical processing plants use Armstrong forged steel traps at 250 lbs., or less, pressure to secure the advantages of all-steel fittings and freedom from damage in event of fire or explosion.

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Send for the new 44-page Steam Trap Book—includes physical data and list prices, service pressure rating tables, list of materials and other data pertinent to forged steel traps *plus* information on cast traps and trap selection, installation and maintenance for all condensate drainage jobs. Free on request—no obligation.

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Phone: DEarborn 2-5446

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Subscription Information — Published Monthly. Price: United States and Possessions $10, Canada $11, one year. Other countries $12.....Single copies $1.00.

Indexed in the Industrial Arts Index and the Engineering Index on file in Public Libraries.

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Power Engineering

Combining POWER PLANT ENGINEERING and POWER GENERATION

This magazine was established in 1896 as Practical Engineer. The title was changed to POWER PLANT ENGINEERING in 1918; to POWER GENERATION in 1948; and to POWER ENGINEERING in May, 1950. Rights reserved to above titles

June, 1952

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To turn it from a liability into an asset, you must make a technical survey. Author tells the instruments you will need for proper measurements, how to use them and what they reveal.

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By A. D. Somes
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How to Size Piping and Valves for Flashing Mixtures 83
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How Sudden Load Changes Affect BF Pumps 86
By I. J. Karassik, G. H. Bosworth and B. J. Schmid
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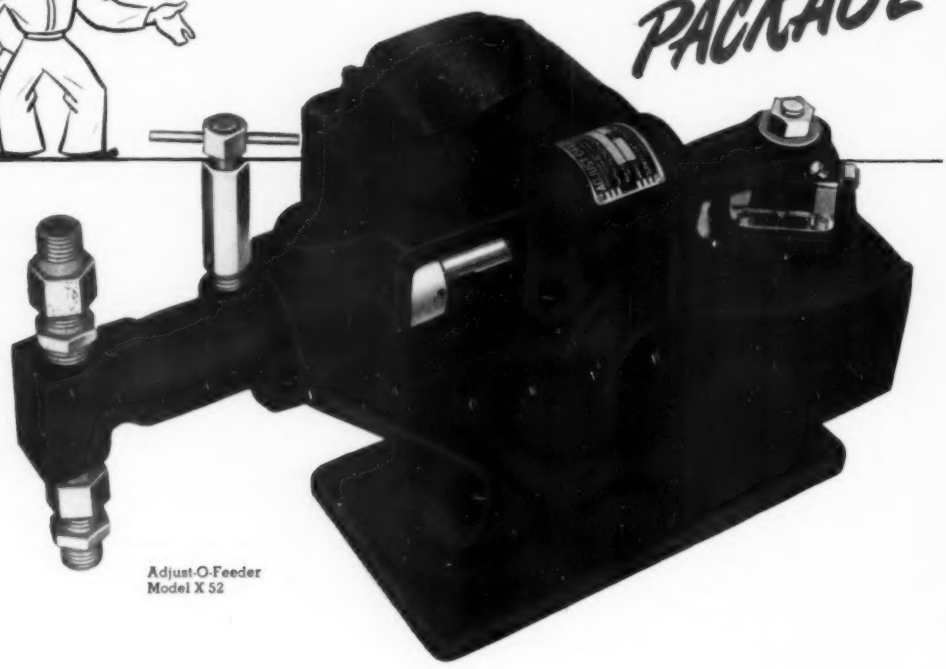
The only magazine devoted exclusively to the engineering interests and the practical problems of all power engineers

NEW BOILER WATER CONDITIONING PACKAGE



Adjust-O-Feeder
Model X 52

- LOW COST
- COMPACT
  Built-in standard motor — no separate gearbox or couplings.
  Built-in oil-enclosed gear reducer.
- MICRO-STROKE ADJUSTMENT
  Scale easily read — crank and connecting rod operate in horizontal plane.
- LONG LIFE AND EASY MAINTENANCE
  One-piece Meehanite iron frame for positive alignment of all moving parts.
  Double check valves on suction and discharge easily removable.

This new, compact chemical feed pump, by %Proportioneers, Inc.%, is inexpensive and provides accurate boiler water treatment for plants where a low capacity, medium pressure pump will meet requirements. The standard Model X 52 has a capacity range from 1 to 10 GPH and will discharge against pressures up to 650 psig. For lower feeds, the unit is available with a range of from 0.5 to 5 GPH. Complete and self-contained, Model X 52 weighs less than 100 lbs. and is ready to operate as soon as piping and motor are connected.

Ask for Bulletin 1105

% PROPORTIONEERS, INC. %

Write to %PROPORTIONEERS, INC.%, 385 Harris Ave., Providence 1, R. I.

Technical service representatives in principal cities of the United States, Canada, Mexico and other foreign countries.

ENGINEERS' PREVIEW

ROTATING DIGESTERS have been put to a new use, to turn cotton seed linters into pulp for rayon and plastics at the Memphis plant of the Buckeye Cotton Oil Co., a subsidiary of Procter and Gamble. The six vessels, similar to the type employed in pulp mills, were designed by The Babcock & Wilcox Co. especially for handling this product. They operate at pressure of 165 psi and temperatures up to 350 F.

★ ★ ★

ALAN HOWARD has been appointed manager of GE's Turbine Division's Engineering Department, and John P. Keller has been named general manager of the Gas Turbine Department. Both appointments became effective April 1.

Mr. Howard has been general manager of the Gas Turbine Department since last May. In his new post, he will succeed Edwin E. Parker, whose promotion to assignments in newly-established departments of the company's Engineering Services Division was recently announced.

Mr. Keller, who has been assistant general manager of the Gas Turbine Department since last May, will succeed Mr. Howard as general manager of the department.

★ ★ ★

EFFECTIVE February 1, 1952, the name of the Central Station Department of the Westinghouse Electric Corp. was changed to Electric Utility Department. The change was made because it was felt that the new name more accurately describes and associates the corporation's activities with the electric utility industry.

★ ★ ★

PRODUCTION of titanium metal is getting into the long-pants stage. To meet vital military requirements, it is being developed at a much faster rate than usual for a newly produced metal.

The world's first small-scale commercial production of ductile titanium metal was started by the Du Pont Co. in 1948. This was in a small unit at the Newport, Del., plant of the Pigments Department. Rated capacity was 100 pounds a day, but its production did well to run half that much. Now a new plant has been built at the same location, which turns out regularly greater-than-ton lots of the metal. Production now is at the rate of 1½ tons per day and is expected to get up to 2½ tons per day in 1952.

TOP OFFICIALS of Stone & Webster Engineering Corp., while conferring recently with Allis-Chalmers engineers at the West Allis Works, witnessed the first carload shipment of pit liner and foundation material for the first of six 34,000-hp, 45-ft head, 100-rpm Kaplan propeller type hydraulic turbines for the Rock Island plant of Public Utility District No. 1 of Chelan county in the state of Washington. The parts for this installation, for which Stone & Webster are agents and consultants, were being shipped five weeks ahead of schedule.

Allis-Chalmers is also supplying for the Rock Island plant six 25,000-kva, 0.9 pf, 13,800-v, three-phase, 60-cycle generators. Five Allis-Chalmers propeller turbines were installed in this plant in 1932, four of them rated 21,000 hp each and the fifth 2,100 hp.

Stone & Webster are also agents and consultants for the Osage project of the Union Electric Co. of Missouri, for which Allis-Chalmers is building two 35,400-hp, 90-ft head, 100-rpm Francis type water wheels to supplement six 33,500-hp wheels furnished by Allis-Chalmers in 1930.

Shown with the first carload shipment of hydraulic turbine embedded parts for the Rock Island plant just before leaving Allis-Chalmers West Allis Works are (left to right on car): E. C. Ness, traffic manager, and J. P. Manning, chief inspector, both of Stone & Webster; (below, first row, left to right) A. G. Johnson, resident inspector; Harold Nunnelee, Allis-Chalmers; S. L. Sanborn, construction engineer, F. C. Mackrell, vice president, manager of purchases, both of Stone & Webster; W. J. Rheingans, manager, hydraulics section, Allis-Chalmers; E. H. Rheinhardt, Chicago manager, Stone & Webster. In background, A. Knapinski, inspector, and M. M. York, manager, New England region of Allis-Chalmers Mfg. Co.

★ ★ ★

BARBER-COLMAN CO., of Rockford, Illinois, will purchase the principal assets of Wheelco Instruments Co., of Chicago. Present plans are to continue current operations in Chicago until such time as manufacturing facilities can be gradually transferred to Rockford in a manner that will result in very little interruption in shipments. No changes are contemplated in Wheelco's national sales and service organization.

★ ★ ★

SUN OIL CO. has reported to American Iron & Steel Institute it had successfully reached its goal of 8000 tons of scrap in the six-month pilot collection campaign it undertook as a guide for the rest of the petroleum industry.

The company added that "while results were highly satisfactory, we are going to take a second look and believe we can come up with considerable additional scrap."

Paul D. Barton, chief engineer of the Manufacturing Department, headed up the Sun Oil drive.

The report was made to Robert W. Wolcott, chairman of the board at Lukens Steel Co. and chairman of the AISI Scrap Committee, who had asked Sun to conduct the drive.

Copies of Sun Oil Co.'s report are being made available to interested petroleum processors and producers as well as certain government offices at Washington and in Canada. If interested in a copy, write Sun Oil Co., 1608 Walnut St., Philadelphia 3, Penna.

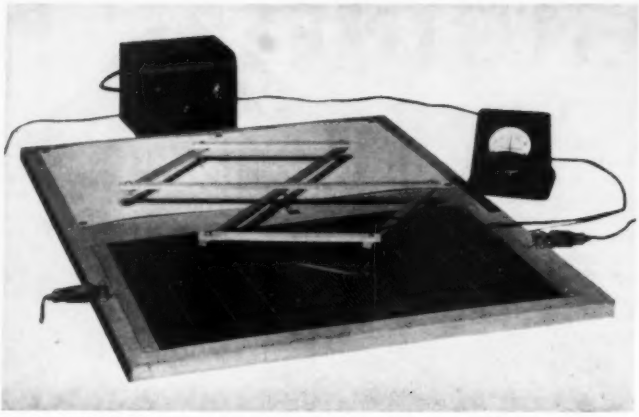
★ ★ ★

FANTASTIC project in progress at the U. S. Waterways Experiment Station near Jackson, Mississippi involves the condensing of the 1,250,000-sq mi Mississippi River Basin into a working model which will cover not more than 200 acres of land. A river system is being created in the model in which water flows, flood plains can be inundated and dams operated, says *The Ohmite News*.

★ ★ ★

ERNEST F. MILLER, veteran Steam Division engineer of the Westinghouse Electric Corp., has been awarded special recognition — and a check for $5,000 — for his outstanding invention of a gas turbine combustor that made possible the successful long-life operation of the first all-American aircraft jet engine.

A. E. Silver, winner of 1951 Lamme Medal



Analog Field Plotter, plotting board, power and voltage divider unit, null detector, pantograph

ONE OF THE HIGHEST honors in the electrical world, the 1951 Lamme Gold Medal, has been awarded to Arthur E. Silver, of New York and Upper Montclair, N. J., retired engineering executive of Ebasco Services, Inc., of New York.

The Medal, which will be presented at the Summer General Meeting of the Institute at Minneapolis, June 23, was awarded to him for his pioneering of rural electrification by designing the simplified farm-type transformer combined with high voltage, long span, and common neutral line construction.

Mr. Silver is the 24th recipient of the Medal which was established in 1924 by the late Benjamin G. Lamme, chief engineer of Westinghouse Electric Corp. to be awarded annually to a member of the AIEE who has shown meritorious achievement in the development of electric apparatus or machinery.

In 1948, Mr. Silver retired from Ebasco Services, Inc. He joined Electric Bond and Share Co. in 1910. In 1919 he was made consulting engineer in charge of all electrical engineering problems for clients. In 1935 when the service activities of the company were transferred to the newly organized subsidiary, Ebasco Services Inc., he became consulting engineer, in which capacity he continued until 1948.

★ ★ ★

ALDEN G. CARLSON was recently promoted to Chief Structural Engineer of Riley Stoker Corporation. Mr. Carlson was graduated from Worcester Polytechnic Institute and acquired subsequent experience with consulting engineers and in structural steel fabricating shops. He joined Riley Stoker Corp. engineering staff in 1933 and has been in charge of the Structural Steel Department of that company since 1937. He is a registered professional engineer and a member of the National Society of Professional Engineers.

A NEW PORTABLE Analog Field Plotter, a tool for rapid solution of complex two-dimensional field problems, has been announced by the Special Products Division of the General Electric Co.

According to the engineers who developed it, the Analog Field Plotter will be a valuable tool in the industrial and classroom study of electrostatic field problems, determination of magnetic flux distribution and intensity, and charting of current flow and temperature distribution in conductors of varying cross-sections and configurations.

The plotter will also be used for such studies as fluid flow patterns and velocity gradients in steam and gas turbine blade grid assemblies, electrode shapes in vacuum and thyratron tube design, and field patterns in wave guides and electron lenses. It may turn out to be very useful to many power engineers.

★ ★ ★

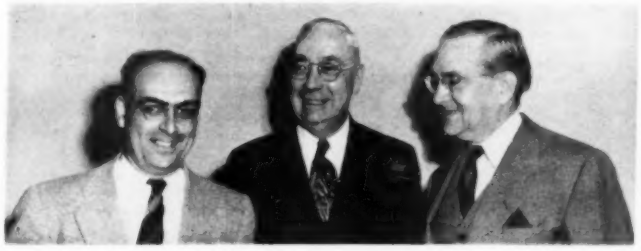
THROUGH Executive Secretary C. L. Warwick, the American Society for Testing Materials, has announced the appointment of Robert J. Painter as new Treasurer of the Society, effective April 15. He succeeds John K. Rittenhouse, who has retired after 43 years of service with this national technical group.

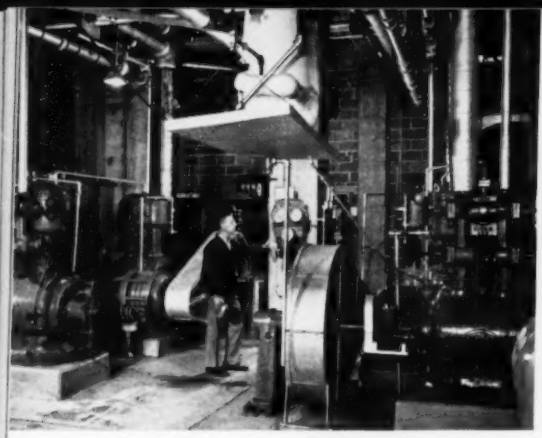
FOR INGENIOUSLY solving a difficult vibration problem that was destroying the four turbine runners and reducing the output at Parker power plant, two Denver Bureau of Reclamation engineers, I. A. Winter and John Parmakian, each received $600. The awards, the largest the Department of Interior can give for efficiency, were made in line with a Departmental program to recognize unusual efficiency, superior accomplishment, and suggestions that save time and money for the government. This one saved Uncle Sam at least one-half million dollars.

The Parker turbines, similar in design to smaller ones which had operated successfully for years, were installed beginning in 1943. In 1946 their vanes were cracking, reducing efficiency of the plant and threatening to cost the government $560,000 for replacement.

Studies made by Winter and Parmakian in 1950 revealed that vortex trails causing vibration were due to the shape of the trailing edges of the vanes. These edges were streamlined, and subsequent operation proved that the redesign had not only cured the vibration but also had increased turbine efficiency, permitting production of $40,000 worth of additional power annually. Mr. Winter has contributed outstanding papers on hydroelectric plant work to the ASME and the former MPC.

Left to right: John Parmakian; L. N. McClellan, Chief Engineer, B of R; and I. A. Winter





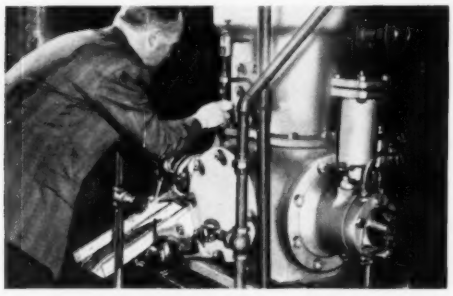
COMPRESSOR EFFICIENCY UP 15%. Six years ago, these Frick compressors were losing efficiency because the oil formed excessive lacquer and carbon deposits. Clogged lines made frequent overhauls necessary. The company changed to Suniso Refrigeration Oil and its natural detergency immediately began attacking the deposits throughout the system. The carbon and lacquer deposits were rapidly carried away to traps and filters, and the system was soon entirely cleaned. Since then compressor efficiency has increased 15%.

SLUDGE AND WAX ELIMINATED. A firm engaged in constructing and servicing industrial refrigeration equipment had constant trouble with compressor oils. Every oil tried lost viscosity excessively under high operating temperatures, vaporized and formed sludge, or formed wax at low temperatures. Complaints were numerous and time lost on call-backs was costly. After consulting compressor manufacturers, the company switched to Suniso. This product immediately solved all sludge, wax and low temperature problems.

SUNISO HELPS INCREASE EFFICIENCY OF 3 REFRIGERATION SYSTEMS

Here are typical examples of how Suniso Refrigeration Oils are helping increase compressor efficiency and are keeping refrigeration system maintenance to a minimum. Following the lead of original equipment manufacturers, more and more maintenance men and refrigeration engineers are safeguarding the efficiency and reliability of their compressors with Suniso.

Suniso Refrigeration Oils meet the requirements of *all* compressors and *all* refrigerants. To get more information, just fill in and mail the coupon below.



SEPARATION TROUBLE ENDED. In this 15-ton ammonia compressor, the oil discolored badly and failed to separate properly from the refrigerant. Excessive amounts of oil carried over into the separators, lowering the efficiency of the entire system. With a switch to Suniso, separation, carryover and discoloration problems ended.

SUN OIL COMPANY—Department PO-6
Philadelphia 3, Pa.

☐ Please send me a copy of the illustrated booklet "Suniso Refrigeration Oils."

☐ Please send me a copy of the technical bulletin "Lubrication of Refrigeration and Air Conditioning Equipment."

☐ Please have a Sun representative contact me.

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YARNALL-WARING COMPANY
114 Mermaid Avenue, Philadelphia 18, Pa.
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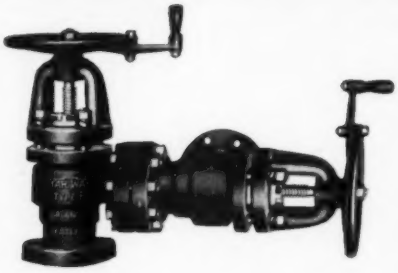
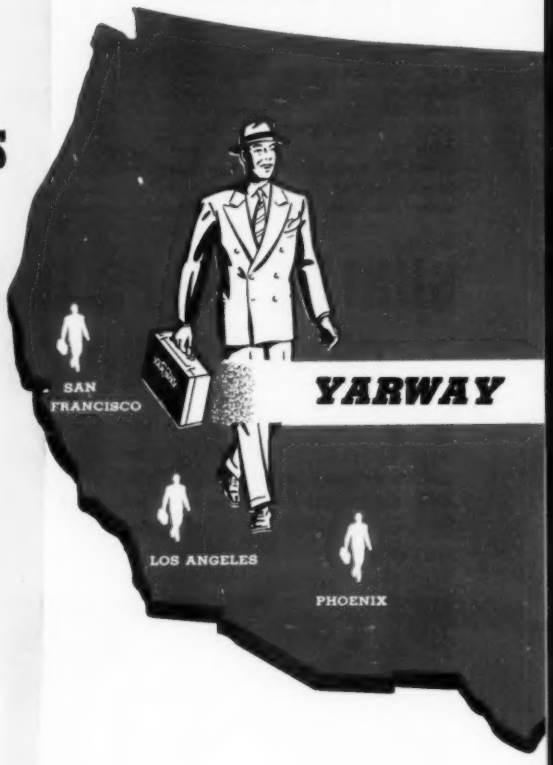
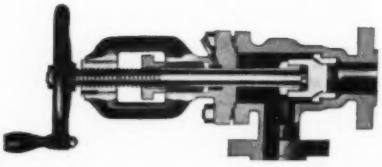
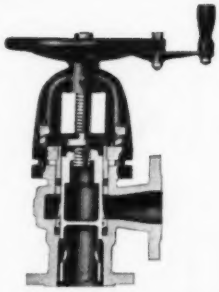


Type B Seatless Tandem Valve combining two angle valves. Iron body for pressures to 250 psi. Steel body for pressures to 400 psi. See Yarway Bulletin B-425.

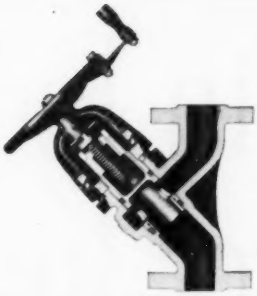




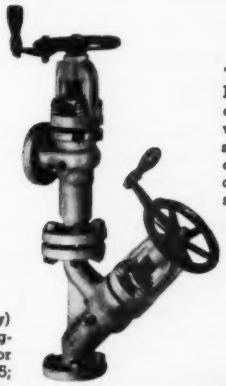
Hard Seat Blow-Off Valve (angle) cone-seat and disc type, with mated stellite seat and disc. Made for pressures up to 2500 psi, flanged or welding ends. See Bulletin B-433.



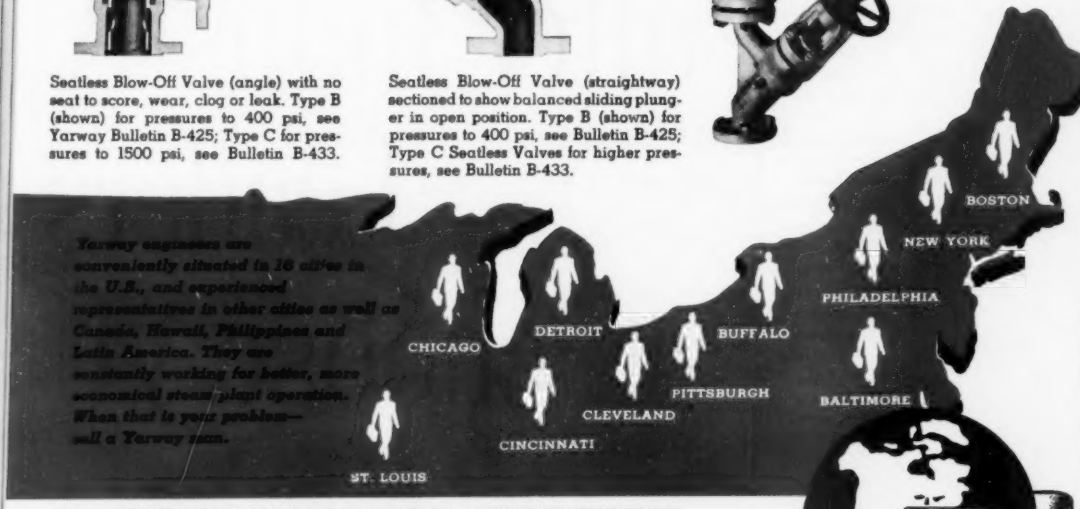
Seatless Blow-Off Valve (angle) with no seat to score, wear, clog or leak. Type B (shown) for pressures to 400 psi, see Yarway Bulletin B-425; Type C for pressures to 1500 psi, see Bulletin B-433.



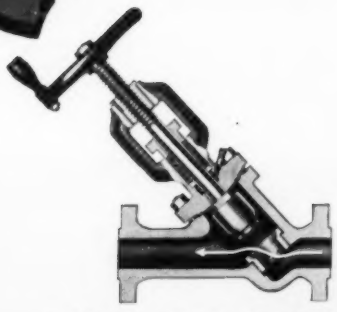
Seatless Blow-Off Valve (straightway) sectioned to show balanced sliding plunger in open position. Type B (shown) for pressures to 400 psi, see Bulletin B-425; Type C Seatless Valves for higher pressures, see Bulletin B-433.



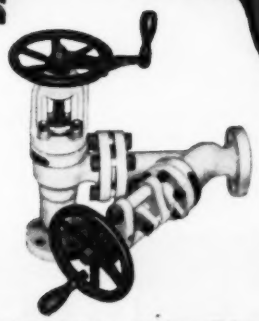
Type C Seatless Tandem Blow-Off Valve combining angle and straightway valves. Angle-angle and straightway-straightway combinations also available. Pressures to 600 psi, see Bulletin B-433.


Yarway engineers are conveniently situated in 16 cities in the U.S., and experienced representatives in other cities as well as Canada, Hawaii, Philippines and Latin America. They are constantly working for better, more economical steam plant operation. When that is your problem—call a Yarway man.
BOSTON
NEW YORK
PHILADELPHIA
BALTIMORE
BUFFALO
PITTSBURGH
CLEVELAND
DETROIT
CHICAGO
CINCINNATI
ST. LOUIS

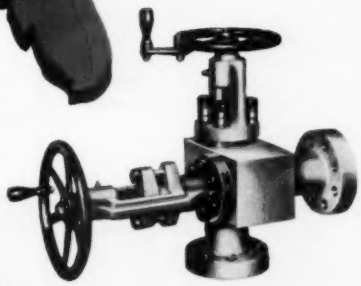
SERVICE GOES ALL THE WAY . . .



Hard Seat Blow-Off Valve (straightway) sectioned to show mated stellite seat and disc in open position. For pressures to 2500 psi. See Bulletin B-433.



Hard-Seat—Seatless Tandem Valve. Hard seat is the blowing valve; seatless is the sealing valve. Available in any combination of angle or straightway bodies, flanged or welding ends. For pressures to 1500 psi. Hard seat—Hard seat Tandems for pressures to 2500 psi. See Bulletin B-433.

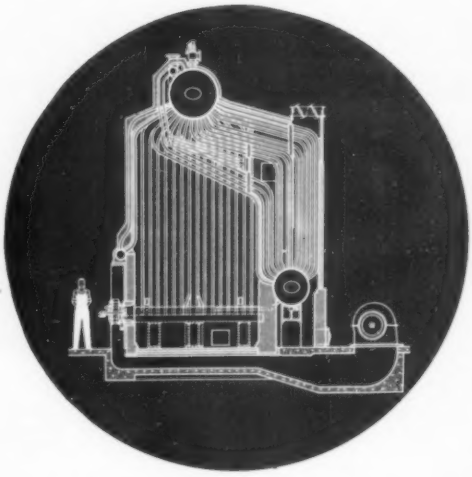


Unit Tandem Blow-Off Valve, combining hard-seat blowing and seatless sealing valve in one-piece forged steel body for pressures to 1500 psi. Two hard-seat valves in tandem also available for pressures to 2500 psi. See Bulletin B-433.

Industries served by VU Boilers

Aircraft
Asphalt
Automobile
Breweries
Building Materials
Carpet
Cellophane
Cement
Chemical
Coal Mining
Coke
Cold Storage
Dairy
Department Stores
Distilling
Explosives
Electrical Equipment
Electric Power
Food Products
Foundries
Gas Works
Gelatine
Glass
Hosiery
Knitting Mills
Institutions
Laundries
Leather
Linoleum
Locomotive
Lumber
Machinery
Metal Producing
Mining
Municipal
Oil Refining
Paint
Paper
Public Utilities
Radio
Railways
Refrigeration
Rubber
Schools
Sewage Plants
Shipbuilding
Sugar
Textile
Tobacco
U. S. Government

in Industry after Industry Leaders choose VU



VU-10 Boiler — This oil or gas fired unit is in a Southwestern plant. Capacity — 60,000 lb of steam per hr; operating pressure — 150 psi; steam temperature — 465 F. VU-10 capacities range from 10,000 to 60,000 lb of steam per hr.

COMBUSTION ENGINEERING

ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

THE story's the same, wherever you go . . . in industry after industry . . . wherever steam is used . . . C-E Vertical-Unit Boilers will be found in the plants of many of the leading companies.

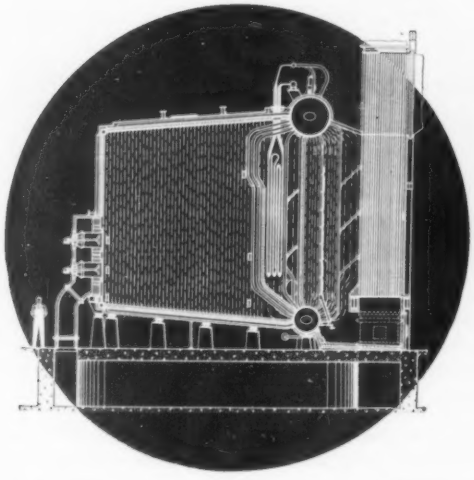
The Petroleum Industry, for example . . . one of the largest users of steam for process and power . . . has installed VU Boilers with an aggregate capacity of many millions of pounds of steam per hour. The list below gives evidence of the widespread acceptance of the VU Unit among leaders of the petroleum industry.

Several of these companies have ordered and re-ordered VU Boilers over a period of years. One company, for instance, ordered its first VU in 1937; another was ordered in 1940, two more in 1942 and another in 1947. The sixth unit was installed in 1950. They know by actual experience what they can expect from a Vertical-Unit Boiler.

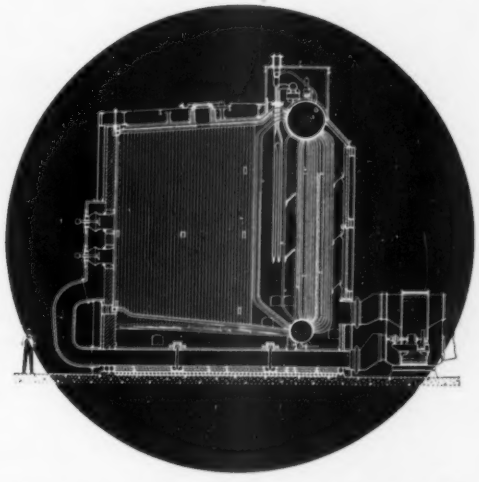
So, if you use steam . . . from 10,000 to 350,000 pounds per hour . . . for power or process, take your cue from the petroleum industry — or from any other field where steam is of primary importance. Investigate the lower steam costs you get with the advanced design . . . sound construction . . . consistent reliability of C-E Vertical-Unit Boilers.

Typical Group of Oil Companies that have purchased VU Boilers for one or more plants

Arabian American Oil Company
Cit-Con Oil Corp.
Cities Service Refining Company
Creole Petroleum Corp.
Esso Refinadora do Petroleos
Gulf Oil Company
Humble Oil & Refining Company
Magnolia Petroleum Company
Pan American Refining Company
Petroleos Mexicanos
The Pure Oil Company
Sinclair Refining Company
Socony Vacuum Oil Company
Stanolind Oil & Gas Company



VU-50 Boiler — This unit is one of two duplicates at an Eastern plant. They are fired with oil or gas. Capacity — 100,000 lb of steam per hr; operating pressure 550 psi; steam temperature — 700 F.



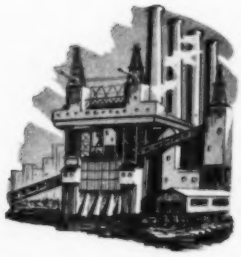
VU-50 Boiler — This is the latest of three duplicate units installed in this Western plant. Fired with oil or refinery gas. Capacity — 250,000 lb of steam per hr; operating pressure — 565 psi; steam temperature 650 F.

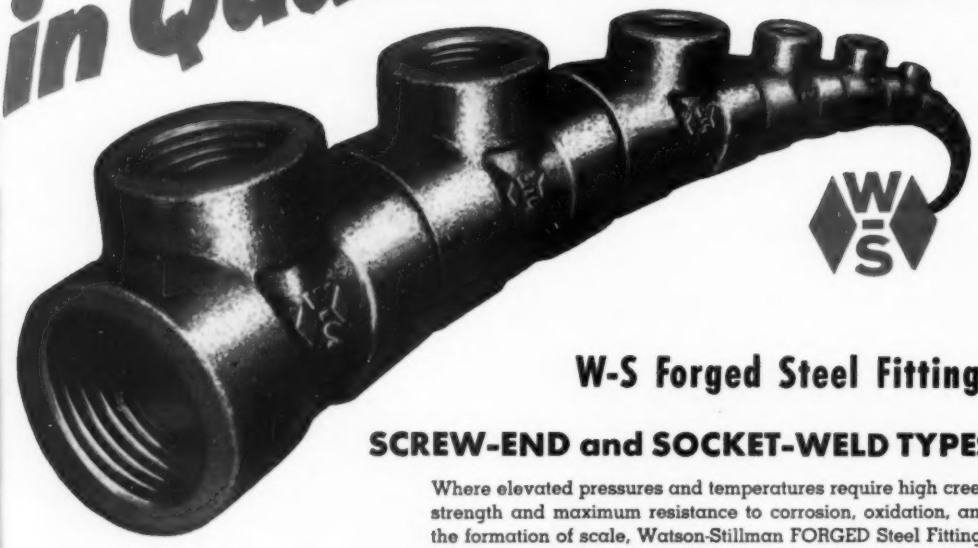
B-571

— SUPERHEATER, INC.
200 MADISON AVENUE, NEW YORK 16, N. Y.

C-E

Quality... in Quantity





W-S Forged Steel Fittings

SCREW-END and SOCKET-WELD TYPES

Where elevated pressures and temperatures require high creep strength and maximum resistance to corrosion, oxidation, and the formation of scale, Watson-Stillman FORGED Steel Fittings deliver the *strength* for *Power* . . . keep equipment on the line to greater operating economy and higher profits.

Quality—in Quantity—has earned and sustained the Watson-Stillman position of first-to-see when industry seeks a solution to a specific fittings problem. Despite an enormous increase in the use of its low *service* cost fittings, Watson-Stillman has never relaxed its concern for the metallurgical aspects of product development.

First to identify itself with the establishment of standards for the properties of special purpose fittings alloys, Watson-Stillman technicians continue in close association with the engineering research efforts of a score of basic industries . . . will be glad to lend a hand on *your* next fittings problem.

9-M-3

• Stronger • Smaller • Lighter • Tighter
• More Uniform • Lower *Service* Cost

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DISTRIBUTOR PRODUCTS DIVISION

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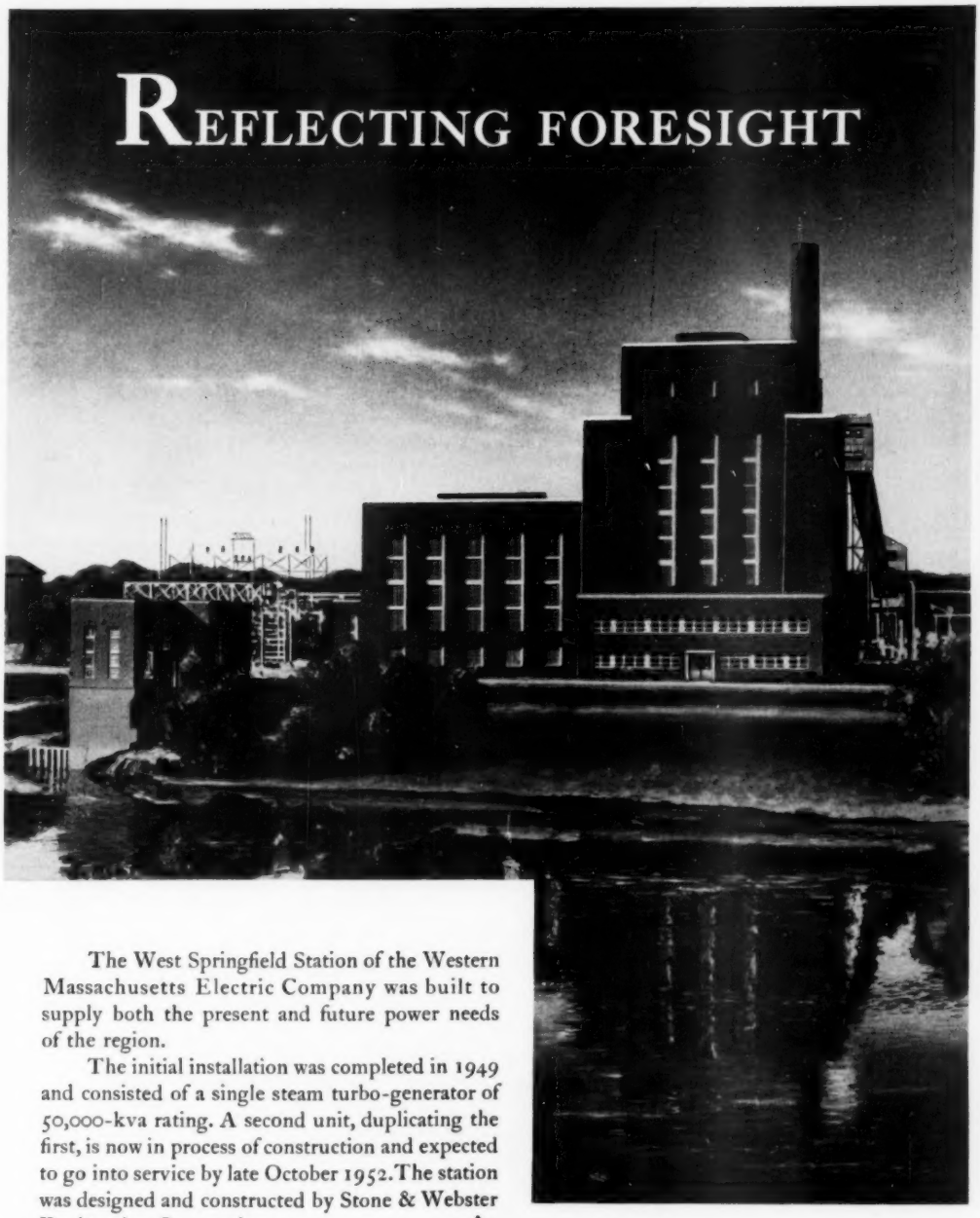
WATSON-STILLMAN
ESTABLISHED 1848

Designers and Manufacturers of Forged Steel Fittings, Wire Rope Shears, Hand Pumps, Jacks, Pipe Benders and Hydraulic Equipment

REFLECTING FORESIGHT



The West Springfield Station of the Western Massachusetts Electric Company was built to supply both the present and future power needs of the region.

The initial installation was completed in 1949 and consisted of a single steam turbo-generator of 50,000-kva rating. A second unit, duplicating the first, is now in process of construction and expected to go into service by late October 1952. The station was designed and constructed by Stone & Webster Engineering Corporation.

STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY *of* STONE & WEBSTER, INC.

This is *PRECISION*

A-C Crane Hoist Control

15 Tons of Steel . . . handled as though it weighed a pound. The picture at the right tells the story. A walnut and wrist watch were placed side by side. The operator lowered the 15-ton, full-hook load. The walnut was cracked. Then the load was raised without the least settling action. The watch was left untouched.

That's Precision . . . precision that is attained on all cranes equipped with the new Westinghouse Load-O-Matic Crane Control. In this particular test, the load was lowered with the master switch set at the first point lower. No jogging, inching or retardation was necessary—lowering rate was smooth and steady.

The Load-O-Matic hoists and lowers *all* loads—the empty hook, light or maximum loads—at stabilized speeds. Loads can be brought to a standstill or suspended by action of the motor only.

VERNIER CONTROL PROVIDES FLEXIBILITY

Additional flexibility of operation is available with the auxiliary Vernier control. This control component is especially useful for high-accuracy spotting. For example—with full load on the hook and the master switch on the first lowering point, operation of the Vernier provides control from approximately 7% of full speed to standstill. Operator can actually float the load into the desired spot.

ASK FOR DESCRIPTIVE BOOKLET B-5417

This booklet describes all the operating characteristics and features of the Load-O-Matic a-c crane hoist control. Ask your Westinghouse representative for your free copy, or write direct to: Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-27015

YOU CAN BE **SURE**...IF IT'S

Westinghouse

CRANE CONTROLS

This simple test of the Westinghouse Load-O-Matic was conducted at a Materials Handling Conference and witnessed by more than 100 engineers. The full load of 15 tons was lowered at an almost imperceptible speed till it cracked the walnut. The watch was not damaged. Then the load was raised without the least settling action.

GET

"PIN POINT CONTROL"

WITH

HANCOCK

FLOCONTROL VALVES

Say "good-bye forever" to filed notches, paint daubs, string tying and other makeshift ways of marking globe valve settings. With Hancock Flocontrol Valves in your lines, you can be sure of "pin point control" of flow, temperature or pressure. The sturdy micrometer dial and pointer attached to the bonnet permits settings to within a 1/100th turn of the handwheel! And, you can instantly duplicate any setting exactly, any time.

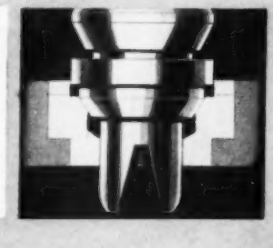
Hancock Flocontrol Valves are available in bronze and steel. Both types are strong, leak-defying valves with scientifically designed V-Port disc that *compels proportional flow throughout the entire lift of the valve stem.* Because these valves have long-wearing Acme threads, straight-line flow is not dependent on the short-wearing, fine threads of a needle valve. The seats and discs are superfinished "500 Brinell" stainless steel. Foreign substances or steam cutting effects are minimized.

Eliminate guesswork. Minimize repairs and maintenance. Install the most efficient and economical valves you can use — Hancock Flocontrol Valves. Get in touch with your nearby Hancock Distributor for complete information.

HANCOCK BRONZE FLOCONTROL VALVES: Types: Globe and Angle. Sizes: ¼" through 2". Screwed Ends. Available in 150# and 300# Series.

HANCOCK 600# STEEL FLOCONTROL WELDVALVES: Types: Globe and Angle. Outside Screw and Yoke. Sizes: ¼" through 4" Screwed, Socket Welding and Flanged Ends. Available with 150#, 300# and 600# Series Flanges.

V-PORT DISC is scientifically designed. Shut-off seating surface is entirely removed and separate from the controlling V-Ports. Wire-drawing and cutting action are minimized. No separate shut-off valve needed. Hancock Flocontrol Valves are "2 in 1" valves. The separate seating surface on the V-Port disc gives you a shut-off valve as well as a control valve.



1877 HANCOCK U.S.A.

When Hancocks go in, valve costs go down

HANCOCK VALVES

A product of **MANNING, MAXWELL & MOORE, INC.** WATERTOWN 72, MASSACHUSETTS

MAKERS OF 'HANCOCK' VALVES, 'ASHCROFT' GAUGES, 'CONSOLIDATED' SAFETY AND RELIEF VALVES, 'AMERICAN' INDUSTRIAL INSTRUMENTS, BUILDERS OF "SHAW-BOX" CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES.

Remember — the trade marks "tt" and "TUBE-TURN" are applicable only to products of TUBE TURNS, INC.

Engineered for efficient flow

EFFICIENT FLOW in piping systems is worth striving for . . . it saves kilowatt-hours and avoids over-investment in equipment. That's why, on this TUBE-TURN Welding Elbow, so much engineering attention is devoted to true circularity, smooth inner walls, and exact radius. They all contribute to minimum flow resistance and reduced pressure loss.

When you specify TUBE-TURN Welding Fittings and Flanges you are specifying careful engineering. Get in touch with your nearby TUBE TURNS' Distributor. You'll find one in every principal city.

Write Dept. C-6 for free booklet "Pipe and Fitting Materials" which gives specifications, properties and welding procedures for various materials.

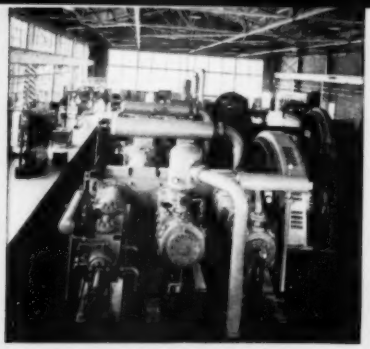
Be sure you see the double "tt"

TUBE TURNS, INC. LOUISVILLE 1, KENTUCKY

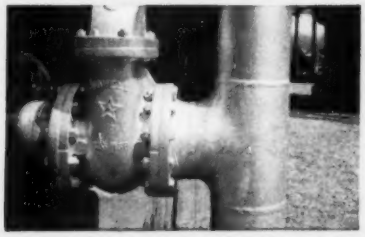
DISTRICT OFFICES: New York • Philadelphia • Pittsburgh • Chicago • Houston • Tulsa • San Francisco • Los Angeles
TUBE TURNS OF CANADA LIMITED, CHATHAM, ONTARIO . . . A wholly owned subsidiary of TUBE TURNS, INC.

Where leakproof piping is imperative... TUBE-TURN Welding Fittings are on the job!

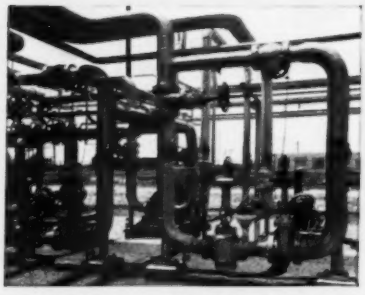
Piping at new Mississippi Chemical Corporation plant handles explosive gases and acids at high pressures. That's why leakproof welded piping was specified, and TUBE-TURN Welding Fittings and Flanges used throughout. Process piping handles hydrogen, nitric acid, anhydrous ammonia, etc. Engineering and construction of entire plant, which produces synthetic nitrogen fertilizer, was handled by The Girdler Corporation.



Design and installation of piping was simplified by obtaining all the necessary types of welding fittings from one reliable source. TUBE TURNS, INC. offers the world's broadest line of welding fittings and flanges—available in a wide range of types, sizes, and more than 40 different alloys.



125-lb. cast iron valve is secured to process line with TUBE-TURN Welding Neck Flanges. True circularity and uniform wall thickness of TUBE-TURN Welding Fittings, such as Welding Tee (right) and Welding Reducer (left) assure proper fit and speedy fabrication. Welders know they can depend on accurate line-up with TUBE-TURN Welding Fittings.



Welded piping using TUBE-TURN Welding Fittings keeps flow resistance and pressure drop to a minimum —an important consideration where so much piping is used. The complete Mississippi Chemical plant is noteworthy for high efficiency throughout . . . unit energy input is lower than in any other similar plant.

Want Materials Data?

Tube Turns, Inc. has prepared a booklet giving specifications, properties, and welding procedures for different pipe and welding fitting materials. If you'd like a free copy, just mail the coupon.

TUBE TURNS, INC., Dept. C-6
224 East Broadway, Louisville 1, Kentucky

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"tt" and "TUBE-TURN" Reg. U.S. Pat. Off.

TUBE TURNS, INC.

LOUISVILLE 1, KENTUCKY

IT'S PACKED WITH SATISFACTION WHEN IT'S PACKED WITH **R/M**

Raybestos-Manhattan Packings and Gaskets, properly installed in your valves, are assurance of long trouble-free service. R/M manufactures a complete line of packings for use against steam, oil, water, gas, beer, acids, alkalies, brine, hydraulic fluids and practically every other commercial fluid. The R/M distributor near you will be glad to help you in selecting the right packings for your equipment.

R/M PACKINGS

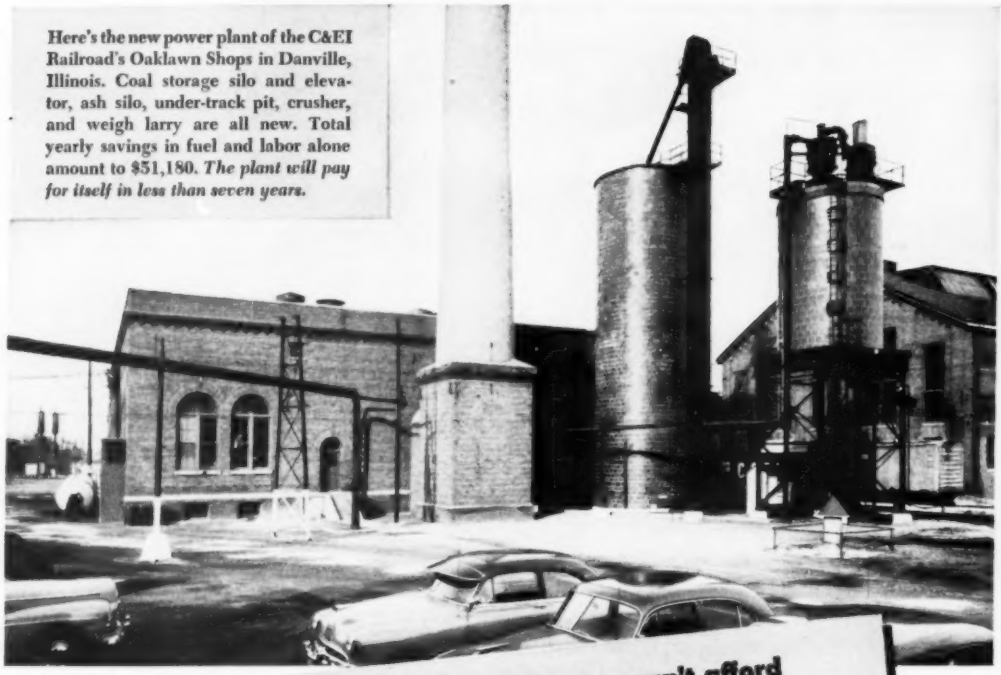
RAYBESTOS-MANHATTAN, INC.
PACKING DIVISION, MANHEIM, PA.

FACTORIES: Bridgeport, Conn.; Manheim, Pa.; No. Charleston, S.C.; Crawfordsville, Ind. Passaic, N.J.; Peterborough, Ontario, Canada

RAYBESTOS-MANHATTAN, INC., Manufacturers of Packings • Asbestos Textiles • Industrial Rubber Products • Abrasive and Diamond Wheels • Rubber Covered Equipment • Brake Linings • Brake Blocks • Clutch Facings • Fan Belts • Radiator Hose • Sintered Metal Products • Bowling Balls

"BURNING **COAL** THE MODERN WAY CUT OUR POWER COSTS

Here's the new power plant of the C&EI Railroad's Oaklawn Shops in Danville, Illinois. Coal storage silo and elevator, ash silo, under-track pit, crusher, and weigh larry are all new. Total yearly savings in fuel and labor alone amount to $51,180. *The plant will pay for itself in less than seven years.*



If you operate a steam plant, you can't afford to ignore these facts!

COAL in most places is today's lowest-cost fuel.

COAL resources in America are adequate for all needs—for hundreds of years to come.

COAL production in the U.S.A. is highly mechanized and by far the most efficient in the world.

COAL prices will therefore remain the most stable of all fuels.

COAL is the safest fuel to store and use.

COAL is the fuel that industry counts on more and more—for with modern combustion and handling equipment, the inherent advantages of well-prepared coal net even bigger savings.

FOR HIGH EFFICIENCY
FOR LOW COST

$51,000 A YEAR!

UP-TO-DATE COAL INSTALLATION CUT FUEL CONSUMPTION 20.3% . . . LABOR FORCE 47%!"

says Mr. George E. Bennett, Supt. Motive Power, Chicago & Eastern Illinois Railroad.

"We recently modernized the power plant at our Oaklawn Shops in Danville, Illinois. Three boilers now do the work that formerly required seven. We've realized great savings in labor and fuel. It's proved to us that, when it comes to both economy and efficiency, you just can't beat *bituminous* coal burned with modern equipment."

This is a view of the firing aisle showing the spreader stokers which are fed by a weigh larry. Man-days per week required to operate the plant have been reduced from 112 to 39! The three new boilers were installed one at a time as the old units were removed, thus not interrupting the operation of the shop.

● Low cost—high dependability—easy, safe storage—coal gives you all these big advantages no matter how you burn it.

But you can get much more!

Cut labor costs to a minimum—handle coal and ashes with automatic equipment . . . burn coal in a *modern* combustion installation—you'll get more BTU's, more steam for every dollar spent.

If you're planning to modernize, or if you're building a new plant, call in a consulting engineer. He'll show you how modern coal equipment, designed to meet your specific needs, can effect a sharp reduction in your operating costs.

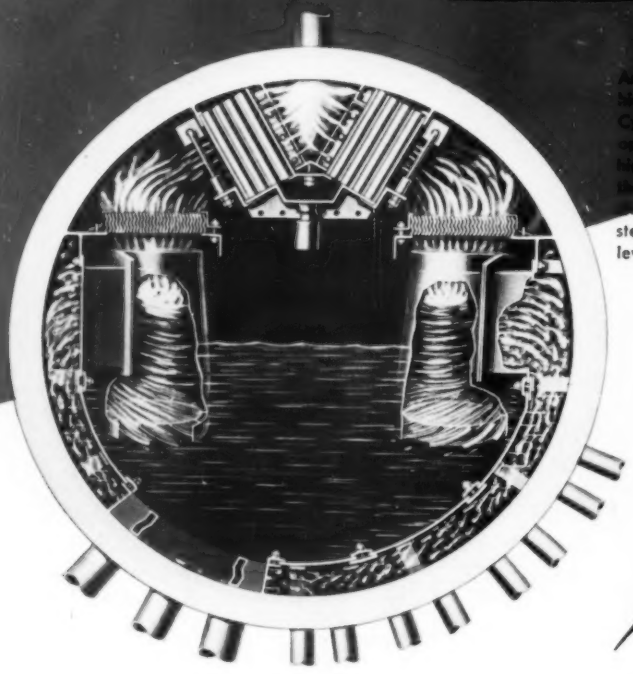
And remember, with coal you have a future dependability no other fuel can offer. America's coal reserves assure an abundant fuel supply far beyond the productive lifetime of your plant. And to mine this coal, America has a highly mechanized, progressive coal industry. Few American industries of any type can match the productivity and increasing efficiency of this nation's coal-mining companies. You can count on coal's economy, on coal's dependable supply—right now and for the future, too!

BITUMINOUS COAL INSTITUTE
A DEPARTMENT OF NATIONAL COAL ASSOCIATION
WASHINGTON, D. C.

YOU CAN COUNT ON COAL!

14 YEARS

of operating experience with STEAM over 2000 PSI



An important element in successful high-pressure operation is the B&W Cyclone Steam Separator, developed by B&W Research. This simple, highly efficient device is typical of the engineering in which B&W's progressive research pushes the science of steam generation to ever higher levels of economy.

For those seeking the high steam-cycle efficiencies obtainable with steam pressures over 2000 psi, B&W offers unparalleled design and operating experience . . . drawing upon a background extending over the last 14 years with units to serve over 8,000,000 kilowatts of generating capacity.

The outstanding performance records of the 12 B&W installations already operating in this range have given strong impetus to the present trend toward use of pressures over 2000 psi . . . have resulted in orders for more than 50 additional B&W units with design pressures up to 2700 psi.

B&W's many years of experience in designing and building boilers for economical, high-pressure steam generation, as exemplified in the list on the opposite page, are at your service.

B&W BOILERS WITH DESIGN PRESSURES OVER 2000 PSI

Owner	Boiler Design Pressure
Diamond Alkali Co.	2200
Indiana & Michigan Electric Co.	2650
Appalachian Electric Power Co.	2300
Indiana & Michigan Electric Co.	2300
The Ohio Power Co.	2300
Commonwealth Edison Co.	2125
Indiana & Michigan Electric Co.	2300
Appalachian Electric Power Co.	2300
Commonwealth Edison Co.	2125
The Ohio Power Co.	2300
Public Service Co. of No. Illinois	2050
Indiana & Michigan Electric Co.	2300
Consolidated Edison Co. of N. Y.	2050
Philadelphia Electric Co.	2075
Consolidated Edison Co. of N. Y.	2050
Pennsylvania Electric Co.	2080
Philadelphia Electric Co.	2075
Detroit Edison Co.	2050
Appalachian Electric Power Co.	2400
Commonwealth Edison Co.	2125
Tennessee Valley Authority	2050
Commonwealth Edison Co.	2125
Detroit Edison Co.	2050
Jersey Central Power & Light Co.	2225
Georgia Power Co.	2100
Southern California Edison Co.	2050
Narragansett Electric Lighting Co.	2350
Public Service Co. of No. Illinois	2125
Tennessee Valley Authority	2050
Ohio Edison Co.	2300
Pacific Gas & Electric	2050
Public Service Elec. & Gas	2700
Appalachian Electric Power Co.	2400
Tennessee Valley Authority	2050
Tennessee Valley Authority	2050
Georgia Power Company	2100
Tennessee Valley Authority	2050
The Ohio Power Co.	2400
The Ohio Power Co.	2400
Ohio Edison Co.	2300

TOTAL GENERATING CAPACITY SERVED: OVER 8,000,000 KILOWATTS.

BABCOCK & WILCOX

G-563T

Revolutionary Performance!

Riley Boiler Unit gives bonus of 20,000 pounds per hour of steam to Masonite Corporation

Here's the maximum capacity guaranteed to Masonite by Riley Stoker Corporation:

50,000 lb. continuous
60,000 lb. for 15 min. peaks

And here's the Masonite report on performance: "For the past 75 days the average hourly load on the new boiler has been 70,000 pounds with peaks of one and more hours' duration of 75,000 pounds."

This same installation called for a guaranteed air heater gas temperature not in excess of 395 degrees at 50,000 pounds of steam per hour. In actual operation at 54,500 pounds of steam per hour, the air heater exit gas temperature was only 377.5 degrees!

No wonder Riley Stoker Corporation, Worcester, Massachusetts, is so well known among leading plants throughout the nation for the highly efficient performance of its boilers!

Coppus-Dennis FANMIX Burners Were Installed

To assure such revolutionary performance, Riley specified Coppus-Dennis FANMIX Burners for its boilers. The exclusive FANMIX action — on *all* Coppus burners, gas as well as combination gas-oil — is the reason for such performances.

FANMIX : Better Combustion : Better Efficiency : Higher Ratings

FANMIX burners, with their *revolving orifices*, give violent mechanical mixing and agitation of gas and air and, therefore, instantaneous and complete combustion with *minimum excess air* (5% excess air not unusual).

Furnace space is not required for mixing; therefore, *higher boiler ratings* are easily obtained.

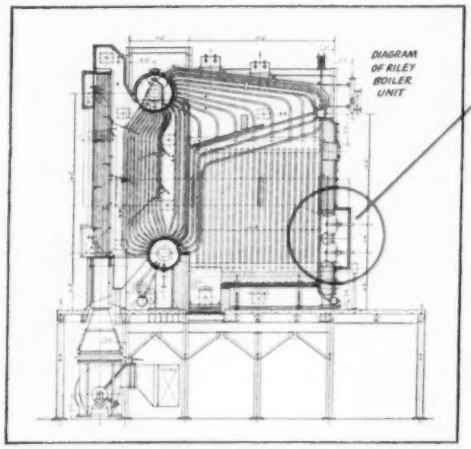
FANMIX burners, with shorter flame than any other burner, cannot cause flame impingement.

FANMIX burners, incorporating a *fan* as an integral unit, have *no draft loss* across the burner. Therefore, regardless of draft conditions, increased ratings are possible.

FANMIX action, with its quick completion of combustion, gives *lower* exit gas temperatures.

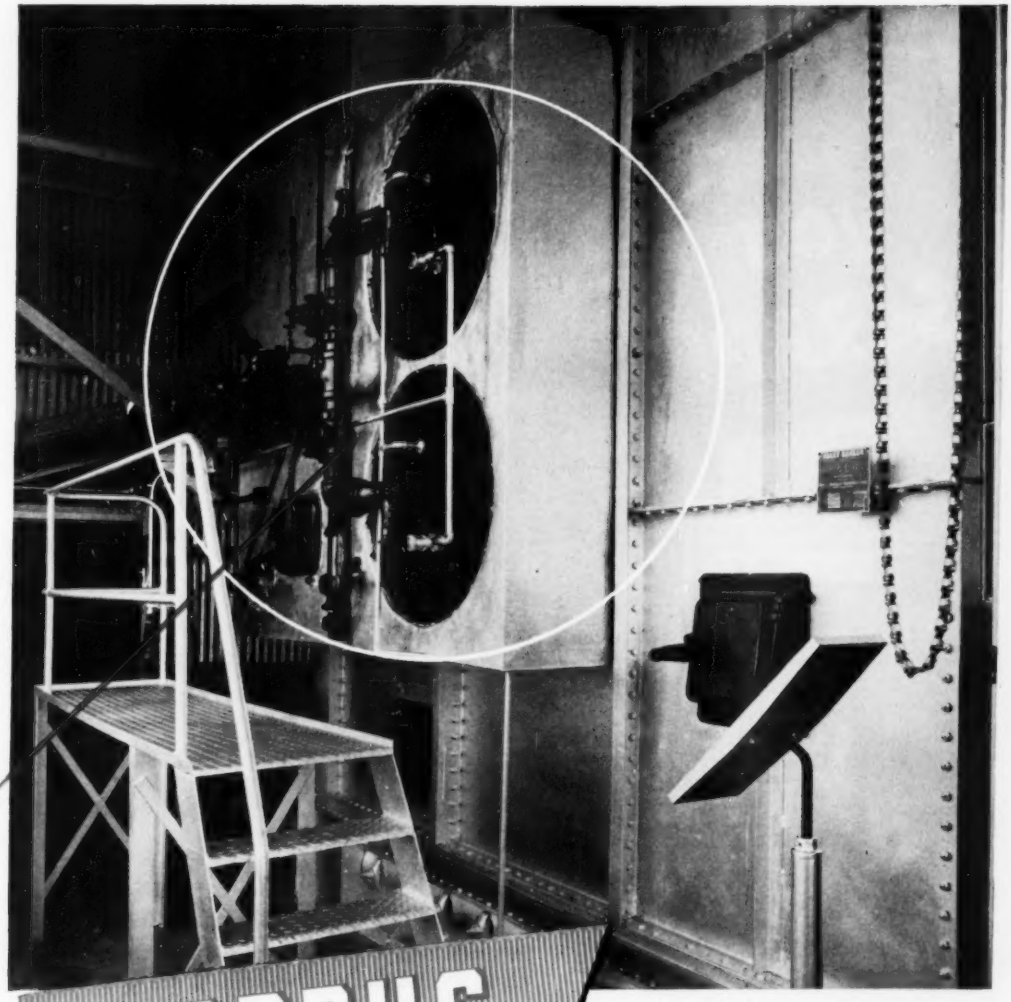
Plan now to take advantage of Coppus-Dennis FANMIX action with your present boiler. Remember — no forced draft equipment nor increase in stack nor increase in furnace volume is required for *FANMIX* operation to get increased capacity. And on *new* boilers, FANMIX lets you plan on reduced combustion space, higher ratings, less stack height or reduced induced draft capacity, and *no* forced draft equipment. Mail coupon today. Sales offices in *Thomas' Register*. Other "Blue Ribbon" Products in *Chemical Engineering Catalog, Refinery Catalog, Best's Safety Directory, and Mining Catalogs.*

JET REACTION is utilized to rotate fan which is integral part of burner. Automatically proportioned high velocity air passes at right angles through fuel to create ideal mixture for fast, complete combustion and peak efficiency.



Well-Known Users of Riley Units with FANMIX Burners Include:

Publicker Commercial Alcohol Co.
Monsanto Chemical Co.
Gaylord Container Corp.
Commercial Solvents Corp.
Celanese Corp. of America
Gulf Power Co.
Mississippi Power Co.
Eagle-Picher Lead Co.
Humble Oil & Refining Co.
Godchaux Sugars, Inc.
Kennecott Copper Corp.
Nicholson File Co.
Bird & Son, Inc.
— and many others



COPPUS

FANMIX® BURNER

GAS . . . COMBINATION GAS-OIL

RILEY BOILER UNIT, using FANMIX burners, is here shown as installed for the Masonite Corporation, Laurel, Mississippi. Circle in diagram at left indicates position of burners pictured above.

SEND COUPON for further information. Coppus engineers FANMIX burners to your individual requirements.

PLEASE ATTACH THIS COUPON TO YOUR COMPANY LETTERHEAD

COPPUS ENGINEERING CORPORATION
166 Park Avenue
Worcester 2, Massachusetts

Please send complete data on Coppus-Dennis FANMIX Burners. I'm particularly interested in
☐ gas ☐ combination gas-oil.

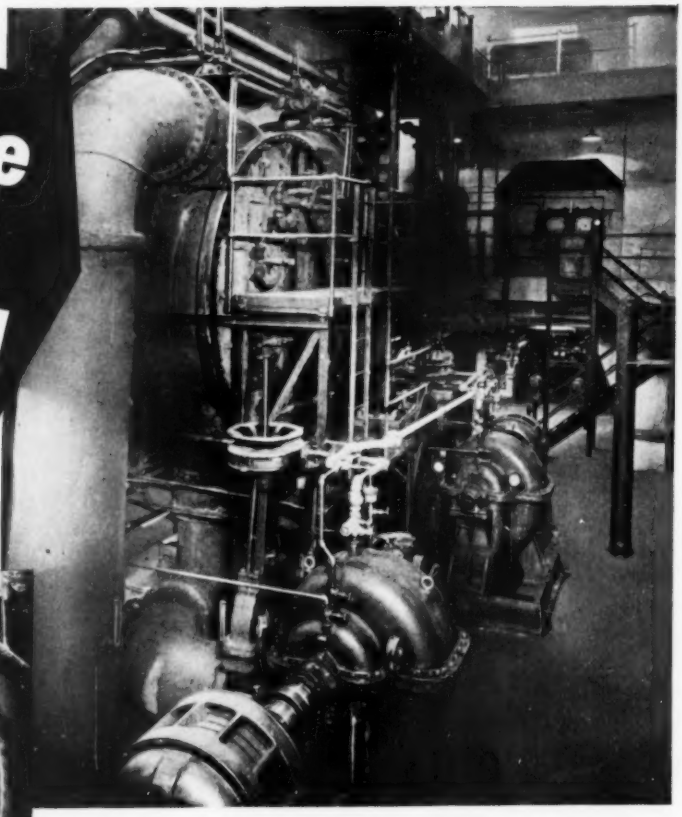
Name..... Title.....

Company.....

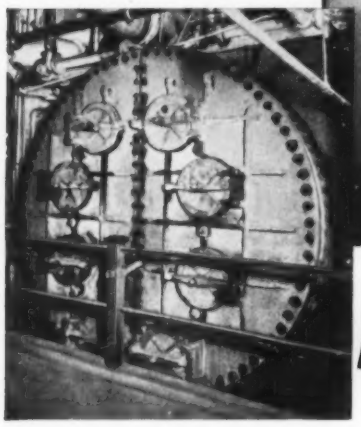
Address.....

City..... Zone..... State.....

Before you SCRAP!



Condenser of the Lynn Gas & Electric Co., Lynn, Mass., which was returned to service by use of inlet-end inserts at a saving of $30,000.



Before you scrap condenser tubes because of inlet-end leaks

GET ALL THE FACTS

It sometimes happens that a combination of erosion and corrosion at the inlet ends of condenser tubes may seem to force their replacement. This is not always necessary. If the damage is confined to a small area at the inlets, and the tubes otherwise are in good condition, they can be saved by using inserts designed especially for just such circumstances. There are several makes available, none made by Revere.

In a recent case, involving a condenser of the Lynn Gas & Electric Company, Revere recommended inserts. Here are the figures: Number of tubes involved, 4,100; Replacement cost, $35,000; Cost of inserts to cure the trouble, $5,000; Saving, $30,000. Repairs should enable the condenser to serve for several more years. The work was so successful that a similar job was done on another Lynn condenser containing 2,700 tubes.

Of course Revere wants to sell condenser tubes, and its other products in copper and copper-base alloys, and aluminum, but we know that fast friends and loyal customers are won by taking to heart the best interests of those with whom we deal. May we have the privilege of working with you on condenser tube matters? Send for free booklet, "Life Extension for Condenser Tubes."

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

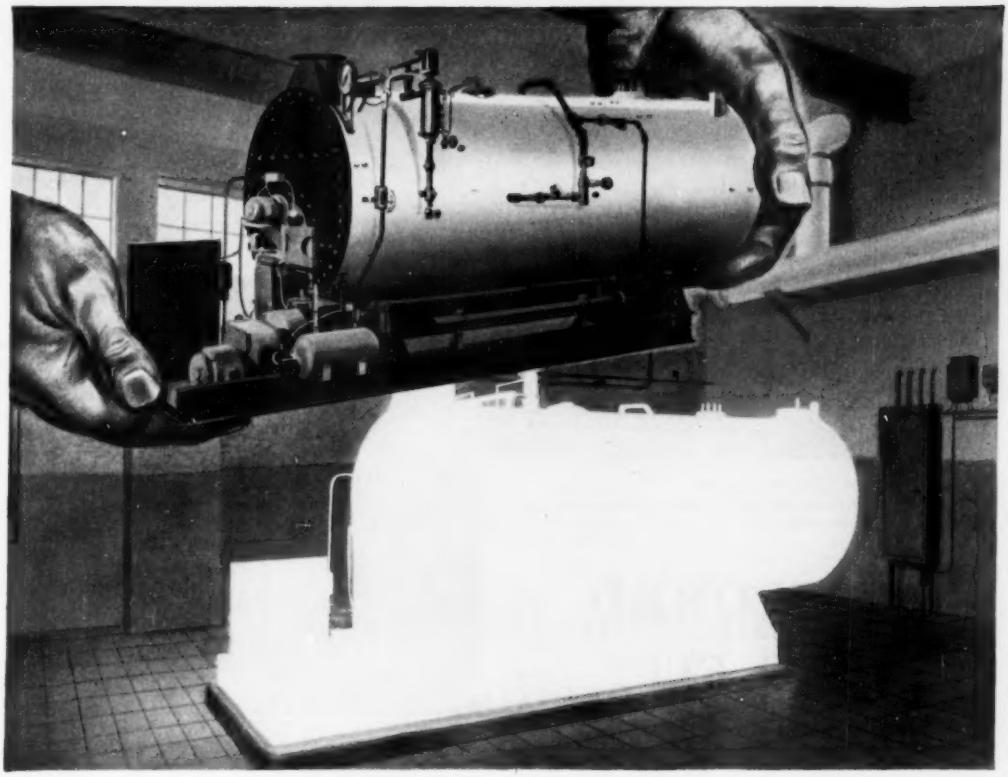
230 Park Avenue, New York 17, N. Y.

• • •

Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.— Sales Offices in Principal Cities, Distributors Everywhere

SEE REVERE'S "MEET THE PRESS" ON NBC TELEVISION EVERY SUNDAY

Ready when you need it...



Save Installation-Construction Time — Expedite Emergency Installations — Serve Immediate Temporary Steam Needs — With a Cleaver-Brooks Self-Contained Boiler

WHEN speed is vital, you can save weeks of valuable installation time with a Cleaver-Brooks boiler — delivered to location as a complete, factory assembled and tested, self-contained unit, with much of the trim and accessories provided.

In an emergency the installation time can be reduced to as little as 48 hours, by following a properly planned and coordinated procedure of providing in advance the required facilities — foundations, headers, service and blow-off lines, fuel tanks and lines.

Prior to the completion of your building, Cleaver-Brooks boilers can be placed in operation to serve immediate steam needs. When permanently installed the change-over takes place with a minimum of labor and expense and the avoidance of interrupted steam service.

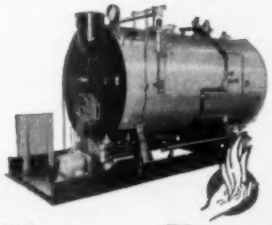
Cleaver-Brooks are the first and finest in modern, self-contained boilers — operate at a guaranteed efficiency of 80% — burn the fuel most available and economical in your area, gas, oil, or combination gas and oil — fully meet all codes — standard models available in sizes 15 to 500 hp; 15 to 250 psi.

CLEAVER-BROOKS COMPANY
Originators of the Self-Contained Boiler
Dept. G-310 E. Keefe Ave., Milwaukee 12, Wis., U.S.A.
Cable Address: Clebro-Milwaukeewis

Write for latest, fully illustrated and descriptive Cleaver-Brooks Steam Boiler Catalog.

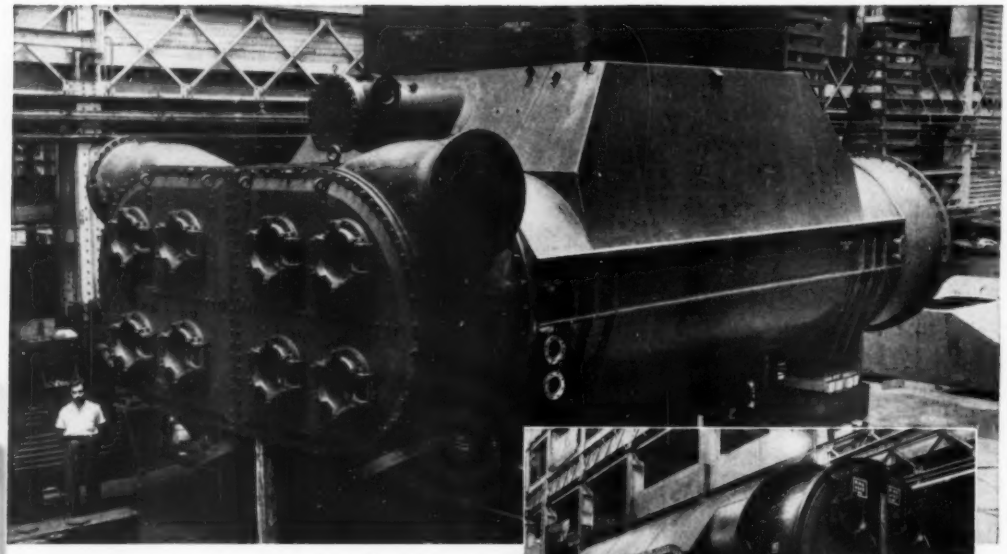
WHY INSTALLATION TIME IS CUT:

- Simple Low-Cost Stack
- No Job-Site Brickwork — No Special Foundations
- Boiler Delivered as a Complete, Factory Assembled, Tested, Self-Contained Unit
- Centralized Responsibility — No Waiting on Multiple Sources of Supply

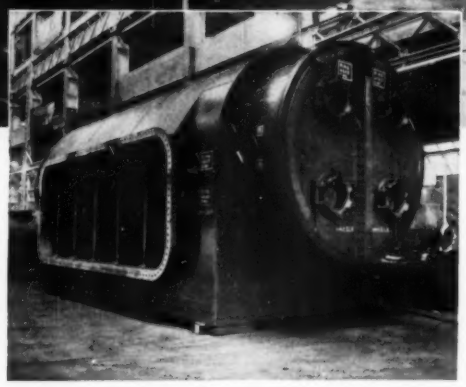


Cleaver-Brooks

Builders of Equipment for the Generation and Utilization of Heat • Steam Boilers • Oil and Bitumen Tank-Car Heaters • Distillation Equipment • Oil and Gas-Fired Conversion Burners



LOW-HEADROOM, OVAL-TYPE CONDENSER (with extraction heater in exhaust neck), is typical of several furnished in sizes ranging from 27,500 to 80,000 sq. ft.



SIDE INLET CONDENSER, one-half of several "twin shell" units serving turbine-generators of 20,000 to 100,000 kw

"TAILORED TO FIT"

Low-headroom design for condensers typical of Worthington "space" engineering

It all began in 1854.

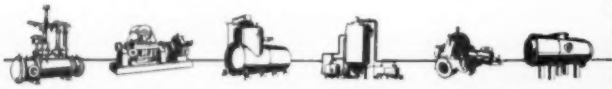
That was the year the first Worthington condenser was installed. From that time, up through the early twentieth-century "evolutionary" period in condenser design, Worthington has constantly kept in step with prime mover and steam power plant development. Today, engineers must design and build condensers within the limitations imposed by high construction costs.

Thanks to the flexible nature of the Worthington "Double Folded Tube Layer", today's "low-headroom" requirements are easily met without any sacrifice in efficiency. For single-shell, beneath-turbine installations, the rectangular box-type (built by Worthington as early as 1904) has given way to the modern "oval" design illustrated above. Other designs include single-shell, side-mounted units with exhaust elbows, and twin shells with horizontal or "T" shaped exhaust connections, popular for outdoor or semi-outdoor plants.

As the capacity of turbine-generators increases, so does the demand for larger condensers. This places more importance on "space" engineering. Worthington—with over a century of experience in the manufacture of steam power equipment—is prepared to build efficient condensers in all sizes to suit any reasonable limitations. (Now under construction for an eastern utility is the largest single-shell unit ever ordered—125,000 sq. ft.)

Write for advice on your new installation, stating requirements. Worthington Corporation, formerly Worthington Pump and Machinery Corporation, Steam Power Division, Harrison, N. J.

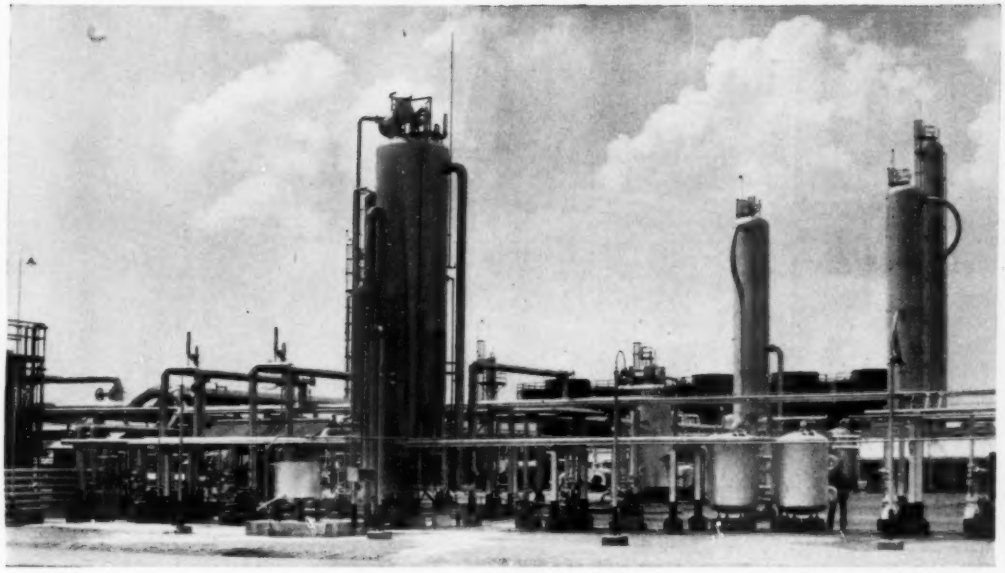
Z.2.1



A GREAT TEAM IN STEAM

WORTHINGTON

Condensers



NORTH COWDEN GASOLINE PLANT near Odessa, Texas, operated by Stanolind Oil and Gas Company. Here Worthington Water Softeners protect boilers from scale-forming deposits.

Worthington softeners protect this plant's boilers 10 ways

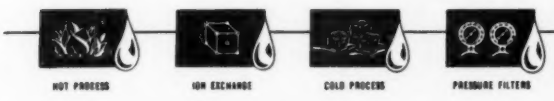
In this case, it's a hot-process softener to remove scale-forming deposits from boiler feedwater.

Let's examine this gasoline plant installation and see how it gives boilers "maximum" protection:

1. *Feed water is softened* by a hot-lime soda system.
2. *Selective deaeration* for operation on make-up only, condensate only, or both.
3. *Non-scaling direct-contact vent condenser* heats and vents treated make-up.
4. *Tubular vent condenser vents condensate.*
5. *Oxygen contamination of feedwater avoided* by last-step deaeration.
6. *Stainless steel deaerating elements.*
7. *Uniform and efficient deaeration* during wide load swings.
8. *Filter backwashing* with clean, hot, chemically inert water without velocity change through the softening zone.
9. *Proportionate sludge removal.*
10. *Uniformly proportionate chemical feed.*

Before you buy, investigate Worthington Water Softening Systems thoroughly. Tell us the service conditions, and get our recommendations in terms of dollars and benefits. Write Worthington Corporation, formerly Worthington Pump and Machinery Corporation, Water Treating Section, Harrison, N. J.

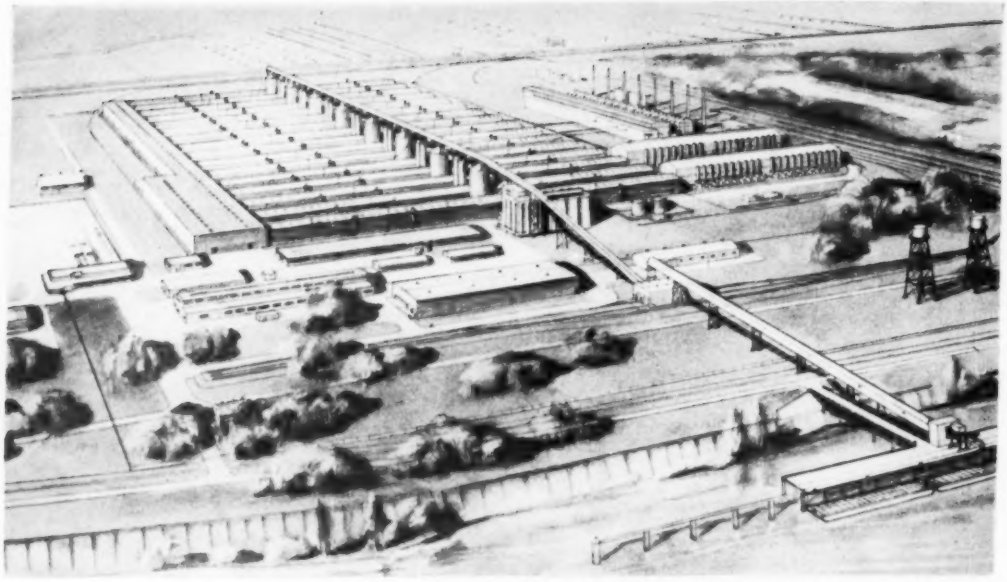
J.1.4



Worthington Makes More of the Equipment for ALL Types of Water Conditioning Systems

WORTHINGTON

Water Conditioning



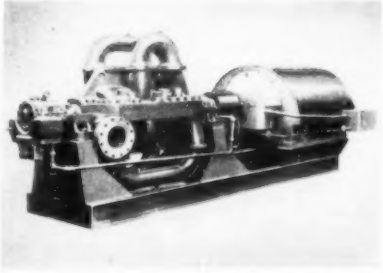
KAISER ALUMINUM AND CHEMICAL CORPORATION'S new 400,000,000 pound-a-year, $150,000,000 aluminum reduction plant at Chalmette, La., designed and built by Kaiser Engineers, is the largest plant of its kind in the U. S. The plant—where production began in December, 1951—uses 19 Worthington boiler-feed pumps and other Worthington equipment including thirty 9,300 square-foot condensers, and fifteen 250,000 pound-per-hour deaerators, 2 steam turbines and numerous circulating pumps.

Power plant at largest aluminum reduction plant to use Worthington pumps, condensers, deaerators

It takes plenty of electric power to produce 400,000,000 pounds of aluminum in a year. And that's what they're doing at the new Kaiser Aluminum plant at Chalmette, La.—largest aluminum reduction plant in the U. S.

Kaiser joins many other top companies in choosing Worthington boiler-feed pumps as well as other key equipment for their new plant. Such choices arise out of an insistence for equipment that's engineered for maximum performance.

Worthington engineering produces boiler-feed pumps of the most advanced design in the field, made from specially selected metals. Each pump is exactly *right* for the pressure and temperature with which it is to perform. Over 110 years of Worthington experience in building pumping equipment go into making this a certainty. Worthington Corporation, formerly Worthington Pump & Machinery Corporation, Centrifugal Pump Division, Harrison, New Jersey. C.2.4

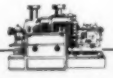


19 WORTHINGTON 250,000 LBS PER HR BOILER-FEED PUMPS at new Kaiser plant, handle feedwater at 257 F against a discharge pressure of 1,030 psig. Pumps are axial-balanced, volute type centrifugals. Two, similar to one illustrated, are driven by Worthington 450-hp steam turbines.

For Boiler Feed Service. Capacities to 1,500 GPM; Heads to 1,000 feet.

For Hotwell, Condensate, Chilled Water Service. Capacities to 1,400 GPM; Heads to 650 feet.

For Water Works, Circulation, Drainage, General Service. Capacities to 135,000 GPM; Heads to 400 feet.

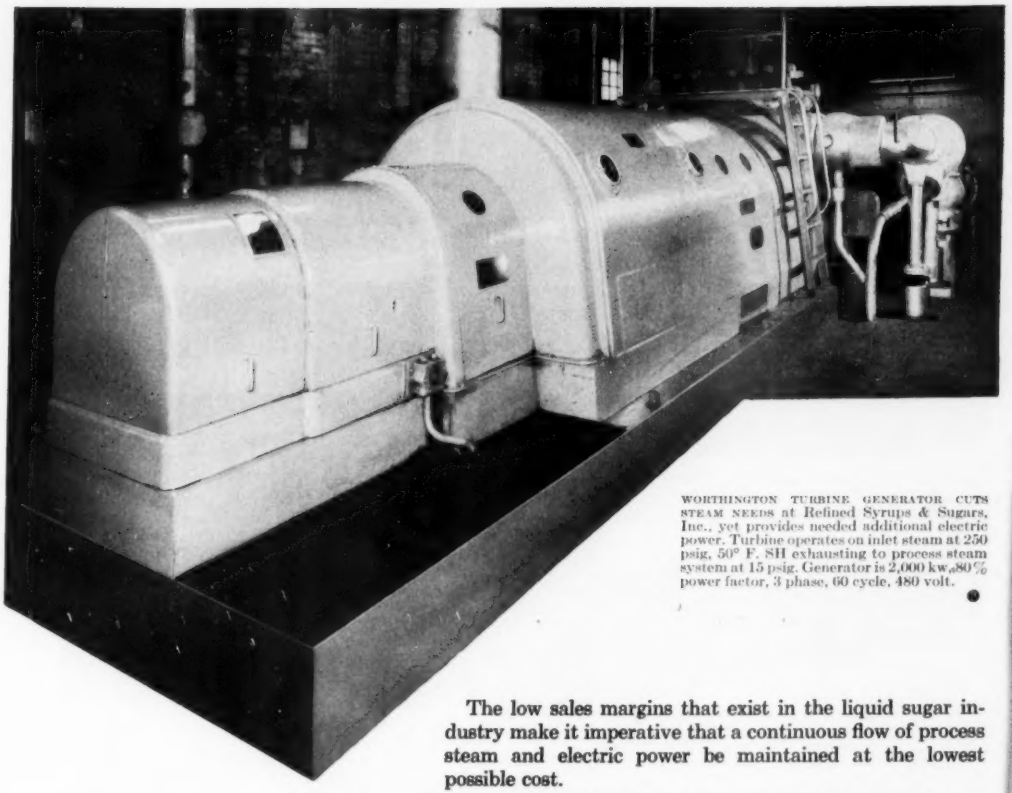


For Boiler Feed Service. Capacities to 3,000 GPM; Heads to 7,000 feet.

The World's Broadest Line Assures You the Right Pump for Every Job

WORTHINGTON

Centrifugal Pumps



WORTHINGTON TURBINE GENERATOR CUTS STEAM NEEDS at Refined Syrups & Sugars, Inc., yet provides needed additional electric power. Turbine operates on inlet steam at 250 psig, 50° F. SH exhausting to process steam system at 15 psig. Generator is 2,000 kw, 80% power factor, 3 phase, 60 cycle, 480 volt.

How Refined Syrups & Sugars got more kw, yet cut steam consumption per kwh by 29%

The low sales margins that exist in the liquid sugar industry make it imperative that a continuous flow of process steam and electric power be maintained at the lowest possible cost.

It was with this fact in mind, and a need for more electric power at economical rates, that Refined Syrups & Sugars of Yonkers, New York, replaced existing steam drives with electric motors and installed a modern Worthington 2,000-kw steam turbine generator.

Not only did this arrangement meet the need for added power requirements, but also reduced the amount of steam consumed in generation of power by 29% per kwh.

By going "Worthington", Refined Syrups & Sugars—like the many other Worthington users—found that unit responsibility has its rewards. Each Worthington turbine generator is designed, assembled and tested *as a complete unit* before shipment.

Sizes to 10,000 kw. Worthington Corporation, formerly Worthington Pump & Machinery Corporation, Steam Turbine Division, Wellsville, New York.

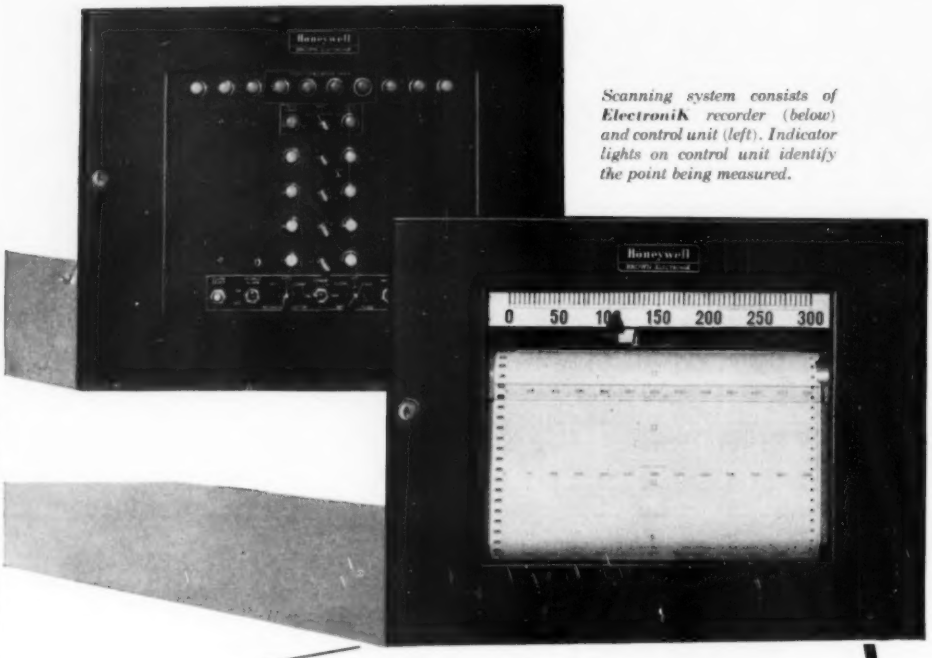
T-2-17

SINGLE-STAGE TURBINES | MULTI-STAGE TURBINES | TURBINE-GENERATOR SETS | FEED WATER HEATERS | BOILER FEED PUMPS | SURFACE CONDENSERS

A GREAT TEAM IN STEAM

WORTHINGTON

Steam Turbine Generators



Scanning system consists of ***ElectroniK*** *recorder (below) and control unit (left). Indicator lights on control unit identify the point being measured.*

Versatility and Convenience . . . through these unique features:

Identifies each temperature . . . . Numbered lights signal the thermocouple being measured. Couples are connected in 30 banks of 9 points each.

Flexible Recording . . . . . Choice of four methods: (1) Successive recording of all 270 points; (2) recording only when set point is exceeded; (3) no recording—scanning only; (4) recording only manually selected points.

Individual temperature limits . . . A separate temperature limit, for operating alarms or automatic start of recording, can be set for each bank of 9 couples.

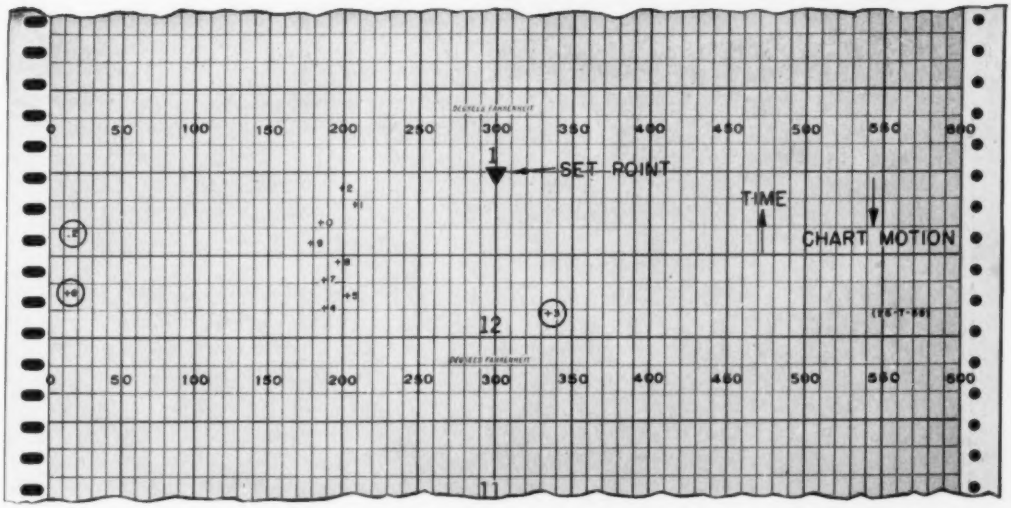
Selective Scanning . . . . . Any bank or banks can be omitted or repeated; choice by selector switches.

Simple Synchronization . . . . . Push-button restoration of proper relation between scanning and printing, if manual operation disturbs synchronization.

Warning Signals . . . . . Operates audible or visual alarms if limit is exceeded by any point.

Fast Scanning . . . . . Average time per point is 1 second, when difference between successive points is 25 per cent of scale span.

Saves Chart Paper . . . . . Chart moves only when instrument is actually recording.



Typical chart record shows how 270 points are recorded on one instrument. Here, point 263 has exceeded the set point. The figures ".2" and "+6" in the left margin identify the first two digits; the last digit, "+3", appears upscale marking the recorded temperature.

Up to 270 plant temperatures *monitored by new* ElectroniK instrument

EVERY power plant has hundreds of potential trouble spots—in bearings, hydraulic couplings, boiler tubes, cooling oil lines—where temperatures should be watched to safeguard equipment and to assure continuous, efficient operation. This new *ElectroniK* instrument affords an automatic, completely reliable means of monitoring these temperatures . . . at unusually low cost per point.

On a single instrument, it can concentrate up to *270 temperatures* . . . bringing them to a single location where operators can inspect them readily. It scans through the thermocouples to which it is connected at a rate of one second per point (when successive temperatures are within 25 per cent of the scale span) . . . checking each point at approximately four-minute intervals. It can perform many functions, at the operator's choice: simple scanning, continuous recording of all points, selective recording, recording of points which depart from specified limits, and operation of annunciator contacts when any point exceeds a preset temperature.

Your savings in labor alone—for manual observation of temperatures and logging of data—will pay for this instrument in short time. And you'll be assured of maximum temperature protection wherever it's needed in your plant.

Ask your local Honeywell engineering representative to discuss your applications for this time-saving, space-saving instrument. Call him today—he is as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4587 Wayne Ave., Philadelphia 44, Penna.

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS

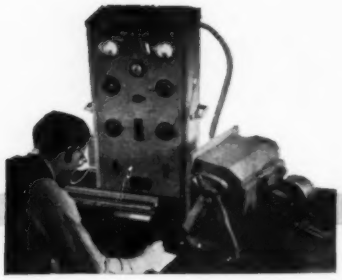
First in Controls

● *Important Reference Data*

Write for Instrumentation Data Sheet No. 10.0-9, "*ElectroniK* Scanning System" and for Catalog No. 90-2, "Supervisory Instruments for Power Generation"

SMALL PLANTS, TOO!

CAN PROFITABLY USE THE *Nalco* SYSTEM



X-Ray equipment, used in the Nalco Laboratories as an aid toward providing positive water treatment results.

● *Water treatment service for small plants is an important part of Nalco's business.*

This indicates two things:

Small plants find Nalco Service Agreements a profitable investment . . . And

Nalco facilities and services are geared to handle — efficiently and economically — the needs of *any* plant, regardless of its size or the volume of water treatment chemicals used.

If your plant is a small one, you can get the same security from water treatment difficulties as many of the world's largest steam generating stations have with Nalco Service Agreements—and at a cost entirely in line with the size of *your* plant and your problems. Write today for complete details, or call your Nalco Representative.

NATIONAL ALUMINATE CORPORATION

6224 West 66th Place • Chicago 38, Illinois

Canadian inquiries should be addressed to Alchem Limited, Burlington, Ontario, Canada

THE *Nalco* SYSTEM . . . Serving Industry through Practical Applied Science

Helpful Bulletins

THE ANSWERS to many of your operating and maintenance problems are found in these new and recently revised catalogs and bulletins. List the paragraph numbers of those you want on the cards on page 127, detach and mail

MECHANICAL POWER TRANSMISSION

101 **Worm Gear Speed Reducers** — General Catalog 400, 180 pp, illustrates and describes each model in company's line of worm gear speed reducers as well as worm and gear sets for built-in power transmission applications. A well organized book for selection and use of worm gearing and worm gear speed reducers. It provides engineering and application data on each unit, including dimensions, weights and rating tables — all the information needed to determine correct drive for your equipment. Available to qualified power engineers. The Cleveland Worm & Gear Co.

102 **Overload Release** — Bulletin A-616 gives full information on the new Tri-Matic overload release designed for company's torque-arm speed reducer. Pictures the release set and tripped, and tells how it offers protection against breakdowns. Includes sizes, prices. Dodge Mfg. Corp.

103 **Speed Reducer Data** — Newly-published Bulletin G-WWH, 48 pp, describes company's complete line of double-worm and helical-worm gear speed reducers. Full data is provided on horsepower, output torque and center distances for reductions up to 3400:1. Detailed information on how to select double reduction gearing, examples of selection hp rating tables, dimension sheets and physical data are included. DeLaval Steam Turbine Co.

104 **Miniature Speed Changers** — Technical Data Sheet 7, newly revised describes company Series 7 anti-backlash miniature speed changers for use where backlash between high and low speed shafts must be zero or a very low value. Metron Instrument Co.

ELECTRICAL

105 **Induction Motors** — Comprehensive features of manufacturer's drip-proof and splash-proof squirrel-cage induction motors are described in illustrated Bulletin 51B7603. These include ratings in 40 C rise continuous rated open drip-proof and 50C rise splash-proof construction, from 15 hp at 450 rpm to 800 hp at 3600 rpm. Allis-Chalmers Mfg. Co.

106 **Boric Acid Power Fuses** — Booklet B-5469, 6 pp, describes a complete line of power fuses for compact and economical short circuit protection. Discusses company's BA De-Ion boric acid fuse, DBA drop-out fuse, and BAL current-limiting fuse. Ratings, construction, operating characteristics and applications are presented for each type. References to literature on each type included. Westinghouse Electric Corp.

107 **Pyrometric Switches** — Newly released Catalog 6800, 12 pp, illustrates and describes manufacturer's rotary, key and plug type pyrometric switches. Applications and pertinent circuits are also given. Dimensions, mounting details and switch circuits are included. Brown Instruments Div., Minneapolis-Honeywell Regulator Co.

108 **Flexible Cable** — Bulletin BA-627 describes a flexible, protected tube cable intended to cut installation costs, save critical materials and offer other advantages. Discusses simplicity of cable, its safety, long lengths available. Includes tubing specifications. Bailey Meter Co.

109 **Ground Fittings Selector Chart** — This chart simplifies proper selection of ground fittings by showing how 20 common combinations of different ground wire and water pipe sizes can be made from only 10 stock parts. UL approved ground fittings for all sizes are illustrated along with complete catalog information. The Thomas & Betts Co., Inc.

110 **The Answers on Wiring** — "20 Questions and 20 Answers on Safety m.i. Wiring," describes and illustrates characteristics and advantages of this new wiring system. A complete table of types, sizes, weights and lengths, as well as a partial list of users included. General Cable Corp.

111 **Variable Transformer** — Bulletin P252 covers company's new Type 10 Powerstat variable transformer. Provides photos, outline dimensions, ratings and other descriptive material on the compact unit. Stresses efficiency, cool operation. The Superior Electric Co.

112 **Auxiliary Power** — Form A-202 is titled "Auxiliary Power for Utilities," and it describes the types and sizes of company's electric plants suited for public utility needs, showing how these plants can be served by company's electric generating plants. Applications illustrated show these units being used for standby purposes and for powering electric tools in powerline construction and maintenance work. Specifications given for 600- to 3000-w size units in both a-c and d-c models. D.W. Onan & Sons, Inc.

113 **Motors, Controls, for Chemical Industries** — Each of eight sections in 32-pp Booklet B-4792 treats a general application problem common to the chemical industry — corrosion, hazardous locations, outdoor service, how-to-get centralized control etc. — and shows how the co-ordinated application of motors and controls provides the solution. Westinghouse Electric Corp.

LAMPS, LIGHTING

114 **Miniature Lamp Catalog** — This 36-pp booklet lists and illustrates hundreds of types of miniature lamps and their applications. Vital statistics including size, life, voltage and cost of each lamp are also given. Miniature lamps are operated on low voltage sources of power, such as dry cells, battery generator systems and lighting circuits with voltage reducing transformers. Lamp Division, General Electric Co.

115 **For Outdoor Lighting** — Form 866 describes and illustrates mercury plunger relays developed especially for street lighting and similar applications. These are standard 30 amp relays mounted in weather-proof housings; for normally open or normally closed circuits. Complete specifications given. H-B Instrument Co.

116 **Street Lighting Engineering Guide** — Booklet B-5460 presents 84 pp of guidance in the design of street lighting systems, including industrial area roadways. Covers such fundamental considerations as purpose of street lighting and quantity required, design procedures, illumination computations and electrical distribution systems. Sample problems and solutions are given. Charts, diagrams and photos illustrate book, and sections on photometric appraisals and light distribution classifications contain distribution and isolux charts. A maintenance section gives data on costs, information on cleaning, relamping. Westinghouse Electric Corp.

117 **For Emergency Lighting** — Form 5246 tells how to prevent sudden lighting failure with the Reide Lightguard, designed to turn on a powerful floodlight when normal current fails. Stresses ease of use, other merits; gives dimensions. The Electric Storage Battery Co.

INSTRUMENTS AND CONTROLS

118 **Control Selection Guide** — Eight-pp Bulletin GEA-5781 on electric and electronic controls, devices and accessories, contains quick-reference selection data, photos and listings of additional publications giving more complete information on each type of equipment. Covers manual, magnetic, combination and reversing motor starters, pushbutton stations; relays; limit switches; solenoids; relays; electronic timers; pressure and vacuum switches; smoke density indicator, other products. General Electric Co.

119 **Temperature Controls** — Twelve-pp Catalog G-17 covers manufacturer's full line of temperature controls, including four new instruments. Provides tables of application and performance for all instruments. Among the new models shown is an electric type with vapor tight cover for use in pneumatic systems. Also covered is the use of controls for temperatures from −300 to 1800 F. The Barber Instrument Co.

120 **Industrial Thermometers** — Catalog 135, 28 pp presents ordering data on a wide range of industrial thermometers, giving scale ranges, dimensions and prices. Features company's Adjust-Angle thermometer designed for use at any angle from to back, left or right, through an 80 deg arc. Gives construction details and advantages of this adjustable-stem type instrument. Weksler Thermometer Corp.

121 **Fundamentals of Instrumentation** — Booklet 80-2, just released, offers 126 pp of information on instrumentation in industry. Separate sections are devoted to the fundamentals of measurement and control, measurement of process variables, remote transmission of measurements, automatic controllers, power units and final control elements, control systems and panelboards. Typical applications are also discussed. Generously illustrated throughout with photos and schematic diagrams. An excellent text available to qualified power engineers. Please state title when requesting it. Brown Instruments Div., Minneapolis-Honeywell Regulator Co.

122 **Bin-Level Control Switches** — Bulletin 11-0 describes and illustrates company's complete line of Tellevel automatic bin-level control switches, introducing new heavy-duty and explosion-proof units. Typical installations are sketched and selection suggestions included. Stephens-Adamson Mfg. Co.

TWO POSTAGE-FREE CARDS are provided for you on page 127. List item numbers of all the bulletins you want

123 **Bin Level Indicators** — Form BD-6 is company's 1953 catalog, 20 pp., covering bin level indicators for use where granular and pulverized materials are stored in tanks, hoppers and bins. Explains how level indicator works, gives dimensions, specifications on three models, along with suggestions as to mounting and use. Stresses advantages of indicators in preventing overflowing, clogging of conveyors, damage to machinery etc. Also describes an aerator unit, used to introduce low-pressure air into dry, finely ground materials to restore their fluid characteristics. The Bin-Dicator Co.

124 **Miniature Indicators** — Specification Sheet 770 describes the operation of a miniature indicating pneumatic receiver that provides manual loading and remote index setting. Illustrates the instrument, shows how it is used in a typical control system. Brown Instruments Div., Minneapolis-Honeywell Regulator Co.

125 **Automatic Alternators** — Bulletin 7100 covers company's automatic alternators. These not only transpose the starting sequence of any two pumps, burners, blowers or other units controlled by magnetic starters or two wire circuits, but have the additional feature of providing locked-in stand-by protection against failure of pilot device or alternator itself. Operation and features of the unit are described, illustrated. Automatic Control Co.

126 **Centralized Instrumentation** — Conventional and graphic type panelboards, as well as the measuring and control instruments utilized are described and illustrated in color in 32-pp Bulletin 55-20. Not an ordering catalog, this book discusses some of the many possibilities of centralized instrumentation and illustrates some typical control systems. Brown Instruments Div., Minneapolis-Honeywell Regulator Co.

127 **Precise Oxygen Determination** — Instrumentation Data Sheet 10.15-0 describes the Beckman oxygen analyzer with Brown ElectroniK recorder for providing an accurate record of oxygen measurement for the entire range of concentration from a few parts per million to 100 per cent oxygen. Brown Instruments Div., Minneapolis-Honeywell Regulator Co.

VALVES, TRAPS AND PIPING ACCESSORIES

128 **Valves of Iron** — Bulletin V-405 gives, in concise form, the general specifications of company's standard iron gate, globe and check valves. Includes valves approved by Underwriters' Laboratories and others for fire line installations, also iron gate valves conforming to specifications of American Water Works Assn. The construction and use of bronze in these valves is shown in cutaway illustrations. The Fairbanks Co.

129 **Corrosion-Resistant Valves** — Bulletin V-217 is a 35-pp service catalog describing types, sizes, operation and features of company's Nordstrom corrosion-resistant valves. Reference is also made to multi-port, steam jacketed and power operated valves and their applications in the chemical and process industries. Typical analyses are given of ten commonly used alloys and tables included listing approximately 175 chemicals with their recommended alloy valves and lubricants. Photos, sectional and dimensional drawings illustrate valve types and practical applications. Rockwell Mfg. Co.

130 **Industrial Steam Traps** — Twelve-pp Bulletin 152 provides engineering and ordering information on steam traps equipped with bellows of bronze, Monel, or stainless, and bodies in bronze, cemented and cast steel construction in ¼ to 2 in. sizes, for pressures from vacuum to 300 lb. Includes besides capacity tables and dimensions, recommended piping diagrams, typical applications, tables and data covering the selection of traps for various types of steam-using equipment. W. H. Nicholson & Co.

131 **Self-Cleaning Strainers** — Bulletin 253 describes pipeline strainers in ¼ to 3 in. sizes. A discussion of the value of sediment control points out various pieces of pipeline equipment needing strainer protection. Also gives specifications and prices. The V. D. Anderson Co.

132 **Air Line Cleaner** — Eight-pp Catalog 252 describes manufacturer's Aridifier, a mechanical device for removing moisture, scale and other impurities from air or gas lines. Explains, illustrates operation, shows some typical applications and gives average cfm requirements. Tells how to select proper size unit, where and how to install it. Includes capacities, dimensions, prices. Logan Engineering Co.

WATER CONDITIONING

133 **Deaerator Data** — Bulletin 2677, 4 pp., describes a deaerator with internal direct contact vent condenser. Advantages of the unit, which heats and deaerates water in three stages, are outlined. Eight-pp Bulletin 2698, on a new vacuum deaerator, explains how the apparatus removes oxygen and free CO_2 from water so as to protect piping, steel tanks, other equipment from corrosion. Both bulletins available, state choice or both. The Permutit Co.

134 **Treatment by Ion Exchange** — Methods of ion exchange treatment and its general and special applications for water and other liquids are exploited in 8-pp Bulletin A. Discusses manufacturer's de-ionizing equipment as to construction and operation and pictures some typical applications. Illinois Water Treatment Co.

135 **Deaerating Heaters** — Bulletin WC 108, 12 pp, on trap-type deaerating heaters, explains principles of successful deaeration and essential elements of a deaerating heater. Features of company's trap-type and spray-type models are given in tabular form and illustrated by drawings with identification of all parts. Also includes photos, flow diagrams. Graver Water Conditioning Co.

MATERIALS HANDLING

136 **Crawler Cranes** — Eight-pp Catalog 700-G-21 describes a new crawler crane and shows several action views of it. Points up availability of interchangeable fronts and lists overall specifications for the new ¾ yard machine. American Hoist & Derrick Co.

137 **Wheel Type Ditchers** — These two new 8-pp catalogs describe and illustrate two models of company's Buckeye ditchers. Bulletin 314 explains in detail the constructional and operational features of a pipeline and utility ditcher with fluid coupling for more efficient power transmission and longer service life. Bulletin 203 covers a versatile, medium utility ditcher featuring ease of accurate operation and efficient power transmission. State choice of bulletin or both. Gar Wood Industries, Inc.

138 **For Bulk Flowable Materials** — Book 2475, 28 pp, contains photos of company's Bulk-Flo, an enclosed feeder-conveyor-elevator assembly, showing it in a variety of applications, together with typical layout drawings, engineering data, calculation tables, charts and formulas. Over 180 materials are analyzed for average weight, size, flowability, and abrasiveness. Link-Belt Co.

139 **Improved Belt Preparation** — Information on company's Magic-Vole plastic rubber for repairing conveyor belts is contained in Form 201, a new folder. Cites actual case histories showing how this compounded has greatly extended life of belts treated. Its use to repair worn spots on belts inexpensively explained. Magic Chemical Co.

RECOMMENDED READING ON EQUIPMENT MAINTENANCE

140 **How to Install, Maintain Traps** — Form 1723 is an 8-pp illustrated folder covering use of company's traps. Installation section covers location of traps, hookups, bypasses, use of strainers, other factors to be considered. A chapter on trouble shooting includes discussion of common troubles as well as mysterious and imaginary ones. Maintenance suggestions include testing methods and inspection procedures. Repair parts list included. Armstrong Machine Works.

141 **Electrical Maintenance Tips** — Booklet B-5477, 36 pp, gives a complete outline of preventive electrical maintenance. Discusses general maintenance programs designed to reduce shutdown time and treats in detail the maintenance of power equipment. A suggested schedule of work and cleaning on power equipment is presented in chart form. Essential information on preventive maintenance for turbines, generators, switchboards, motors, controls and other electrical apparatus is provided. Frequency of inspection and care is covered. Westinghouse Electric Corp.

142 **Centrifugal Pump Handbooks** — Two instruction booklets covering the installation, operation and repair of company's single-stage single-suction and multi-stage centrifugal pumps are available. They include illustrated description of such late developments as Magic-Grip couplings, universal joint couplings with Magic-Grip bushings, mechanical seals. Suggest regular inspection procedures and include pages for maintenance records. Also provide handy reference tables explaining how to locate trouble and listing causes and cures. Bulletin 08X7913, 24 pp, covers single-stage pumps; Bulletin 08X7790, 48 pp, covers the multi-stage pumps. State choice or both. Allis-Chalmers Mfg. Co.

143 **Battery Maintenance Chart** — This 17 by 32 in. check chart is offered to improve maintenance of stationary batteries. Tabulates procedures to follow in basic maintenance operations and shows how often each should be done. Illustrated with five cartoons, it establishes rules to follow in charging batteries, adding water, keeping records, cleaning, locating, installing and connecting batteries. Instructions cover float and periodic charge methods along with equalizing and emergency charge procedures. Gould-National Batteries, Inc.

144 **Unit Heater Maintenance** — "The Care and Maintenance of Steam and Hot Water Unit Heaters" is a well illustrated folder covering proper procedure in getting the most out of these heating units. Discusses system corrosion. Industrial Unit Heater Association.

DUST COLLECTING

145 **Cloth-Bag Dust Collector** — Eight-pp Bulletin 914 introduces company's new cloth-bag dust collector for carbon black, cork, fine wood, graphite, pigments, soap, lime, metal oxides. Illustrated by photos and line drawings, tells how collector works, is installed and maintained. Gives specifications of standard collector sizes and dimensions. Tells how easily this collector

(*Continued on page 186*)

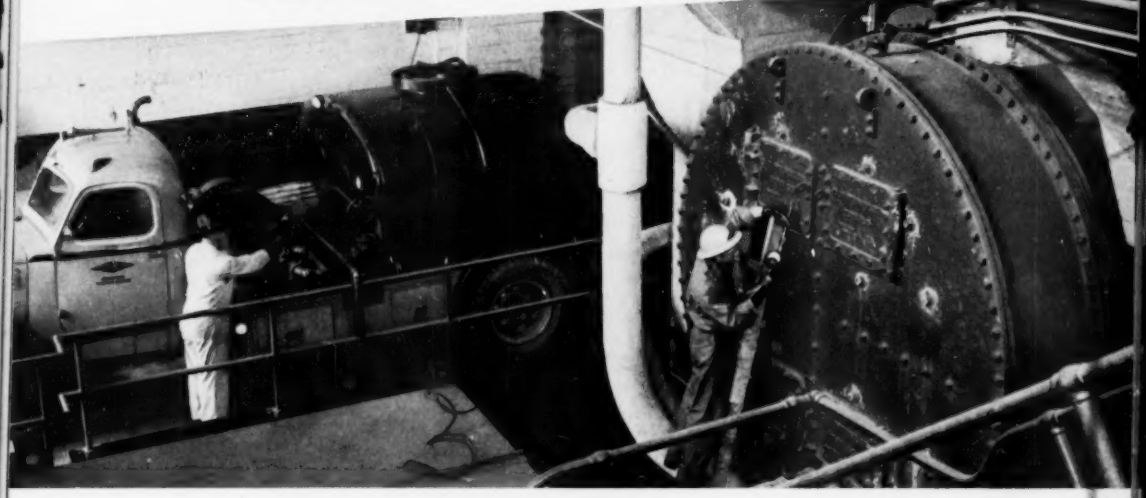
SEE PAGE 127 for postage-free cards.
List item numbers of bulletins wanted

DOWELL SERVICE

CHEMISTRY APPLIED TO MAINTENANCE CLEANING PROBLEMS

This Utility asked:

"Can You Clean a Turbo-Condenser Fast?"



Dowell Service lowered back-pressure on turbine 20%... in only 19 hours

It's results that count! Here's the record of an Ohio utility company that called Dowell to clean a large turbo surface condenser.

BEFORE cleaning:

Steam required per kilowatt hour produced = 9.5 pounds
Steam supplied to turbine = 609,000 pounds per hour
Electricity produced = 64,000 kilowatt hours
Back-pressure on turbine = 2.8 inches mercury

AFTER Dowell Service:

Steam required per kilowatt hour produced = 8.93 pounds
Steam supplied to turbine = 562,000 pounds per hour
Electricity produced = 63,000 kilowatt hours
Back-pressure on turbine = 2.2 inches mercury

But that's just part of the story! Only 19 hours elapsed from the time Dowell arrived on the job until the condenser was inspected, found metal clean and placed back in operation. Dowell Service eliminates all scaffolding and dismantling, saving costly downtime. Deposit-removing liquid solvents are applied to the equipment under expert supervision. All necessary pumps and chemicals are brought to the job in special Dowell-designed trucks. And always, proper protection of your installation is the foremost concern of Dowell engineers.

Whether it's heat exchange equipment, processing equipment, water lines or any of a hundred maintenance cleaning jobs, you'll find Dowell Service is fast, efficient and economical. There's a Dowell office located near you to make free estimates on your cleaning problem.

Other recent Dowell jobs:

Before Dowell Service, three boilers were averaging 85,000 pounds of steam per hour. After Dowell Service, performance on each picked up to 100,000 p.p.h.

•

Water well problems? Before Dowell Service, a municipal well produced 87 gallons per minute at 40 feet drawdown. After treatment well produced 800 GPM at 11 feet drawdown!

•

Outage time for die roll in a plastic company costs $1,000 per hour. To clean this roll manually requires 24 hours. Dowell Service cleaned it and had it back in operation in 6 hours.

DOWELL INCORPORATED • TULSA 1, OKLAHOMA

CALL

New York 20	Ft. Worth 2	Atlanta	Mt. Pleasant, Mich.
Boston 16	Chicago 4	Indianapolis	Hamilton, Ohio
Baltimore	St. Louis 8	Louisville	Charleston, W. Va.
Wilmington 99	Kansas City 8	Upper Montclair, N. J.	Salem, Illinois
Richmond 19	Wichita 2	Ardmore, Pa.	Beaumont, Texas
Jacksonville 2	Oklahoma City 2	Anniston, Alabama	Borger, Texas
Buffalo 2	Houston 2	Hattiesburg, Miss.	Midland, Texas
Cleveland 13	New Orleans 12	Lafayette, La.	Wichita Falls, Texas
Pittsburgh 19	Shreveport 69	Dearborn, Mich.	Hobbs, N. Mex

★*Maintenance cleaning service for industrial heat exchange equipment.*
★*Chemical services for oil, gas and water wells.*

DOWELL

A Service Subsidiary of
THE DOW CHEMICAL COMPANY

First with Super

ALLIS-CHALMERS INSTALLS STEAM TURBINE GENERATOR UNIT WITH SUPERCHARGED HYDROGEN COOLING

SUPERCHARGED HYDROGEN COOLING—the greatest advance yet made in turbine-generator design—is here *now*. This 60,000 kw unit is installed and running at the Edgewater station, Sheboygan, of the Wisconsin Power & Light Company.

Allis-Chalmers is first to develop and apply the principle of directly cooling the conductors with high velocity gas. This unit is the pioneer of a new design trend. Following operating experience, the utility ordered two more similar units, with reheat, for its new Rock River station.

As compared to the 35 percent output gain hydrogen cooling gives over air cooling, supercharged hydrogen cooling increases generator ratings *70 percent* over ordinary hydrogen cooling. Significant gains are made in increasing light load efficiencies and decreasing foundation and building requirements!

The Edgewater turbine has these outstanding features:

Hydraulic control and operation with accessible placement of main stop valve; centralized grouping of operating controls; shaft-driven centrifugal pump simplifying location of oil tank; cam-operated inlet valves accessibly located on top of cylinder, and exclusive A-C method of temperature compensation for horizontal *and* vertical thermal movement.

All oil piping is above the floor, simplifying foundation and installation. And, as throughout the complete Allis-Chalmers line — ranging from the smallest single cylinder machines to single shaft, tandem compound, condensing units of 150,000 kw — labyrinth steam seals are used. The steam sealed gland system is self-contained, and provides operational safety with minimum attention.

You get the real design advances *first* from Allis-Chalmers. When planning the installation or expansion of a steam-electric power plant, let A-C simplify your problem. This *one* source will provide you with the world's widest range of power plant equipment. Bulletin 03B6801A on standardized steam turbine units and other literature on all products listed are available. For your copies, call your nearest A-C office or write to Allis-Chalmers, Milwaukee 1, Wis.

A-3645

ALLIS-CHALMERS

World's Widest Range of Power Plant Equipment

TURBINES & GENERATORS | CONDENSERS & PUMPS | SWITCHGEAR & BREAKERS | MOTORS & CONTROL | TRANS-FORMERS | WATER CONDITIONING

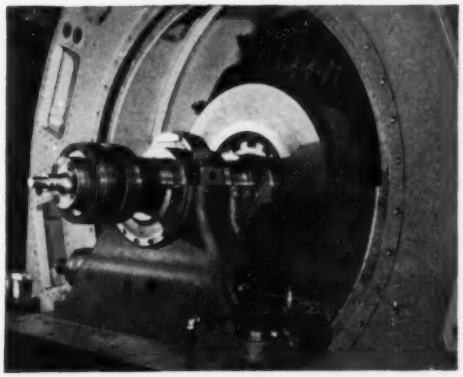
Charged Cooling!

Other ALLIS-CHALMERS FIRSTS

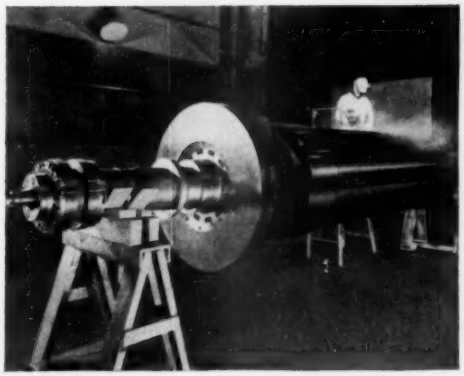
Simplified hydrogen seal and control
World's lowest exhaust pressure steam turbines
Solidly-bolted-down steam end pedestal
Turbine for one-boiler-per-turbine arrangement
"Walk-in" exciter housing
30,000 Kw, 825 F turbine, in 1931
825 F reheat turbine, in 1935

AND NOW . . . **First with supercharged hydrogen cooling!**

This 60,000 kw, 3600 rpm AIEE-ASME preferred standard unit is driven by an Allis-Chalmers tandem compound steam turbine. Steam conditions are 1250 psig, 950 F, 1½ in. Hg abs exhaust. The Edgewater station consists of this and two Allis-Chalmers 30,000 kw units.



Twenty years of Allis-Chalmers blower experience aided in the design of the new rotor ventilating system. The two stage centrifugal compressor at the exciter end of the rotor "supercharges" the hydrogen to several times the pressure obtained from the usual cooling fans. Its output is cooled separately and directed into the rotor from both ends.



Shop view of rotor during construction. Instead of being sent to vent ducts in the rotor teeth, the hydrogen is directed *through* the rotor conductors. The gas is in intimate contact with the copper right where the heat originates. This improved ventilation permits a reduction in unit length and consequent reduced building space requirements.

BRINGING YOUR COAL HANDLING COSTS

Down to Earth

Concrete Silo Storage with live storage shelf, track hopper, double-chain bar feeder, centrifugal discharge bucket elevator, scale and monorail bucket.

Tile Silo Storage with track hopper, bar feeder, bucket elevator, 2000 lb. weigh larry.

Cylindrical Steel Tank Storage with feeder and conveyor.

Suspended Steel Bunker Storage showing bunker and weigh larry.

When coal handling costs are too high for comfort, remember Gifford-Wood's 4-basic design story. Each of these storage designs—concrete silo, tile silo, cylindrical steel tank and suspended steel bunker—are carefully engineered to meet specific limitations of climate, capacity, space available and cost. The combination of extensive engineering experience and well known manufacturing ability assures installations of highest possible operating efficiency at reasonable cost.

A Gifford-Wood engineer, thoroughly familiar with coal handling problems, is at your service. Let him study your needs and recommend a G-W system that will both simplify the operation and reduce your costs.

4 BASIC G-W WAYS TO CUT COAL HANDLING COSTS

1. Reinforced Concrete Silo Storage
2. Vitrified Tile Silo Storage
3. Cylindrical Steel Tank Storage
4. Suspended Steel Bunker Storage

Bulletin No. 300 describes, with illustration and working drawing, these 4 basic G-W types of handling systems. Write today for your copy.

GIFFORD-WOOD CO.

SINCE 1814
Hudson, N. Y.

NEW YORK 17
420 LEXINGTON AVENUE

CHICAGO 6
565 W. WASHINGTON STREET

ST. LOUIS 1
RAILWAY EXCHANGE BUILDING

Ⓡ 6578

G-W HANDLES IT . . . faster · easier · cheaper

For trouble-free
flow control, install
POWELL VALVES
Because Powell Valves are engineered to meet the specific conditions under which they must operate, they have an enviable reputation for long, dependable performance with minimum maintenance.
That is why there are more kinds of Powell valves in service today than any other make.
The Wm. Powell Company
Cincinnati 22, Ohio
Fig. 11303 W. E. 1500-pound Cast Steel Pressure Seal Gate Valve with welding ends. One of many Powell designs for Power Plants
POWELL
BRONZE, IRON, STEEL AND CORROSION-RESISTING VALVES
DEPENDABLE VALVES
SINCE 1846

Again it's Edward Valves in over

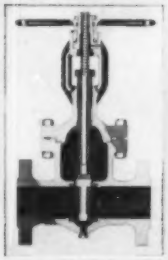
THE EVIDENCE: **456 out of 476 (95.8%) of new central station and municipal power plant projects scheduled to start operation in 1952 or earlier use EDWARD steel valves.**

(Source—1948, 1949, 1950 and 1952 McGraw-Hill surveys of central station and municipal power plant installations. None published in 1951.)

TYPICAL EDWARD DESIGNS GOING INTO NEW STATIONS

Cast Steel Non-Return

Cast Steel Stop



Cast Steel Gate

Cast Steel Check

Forged Gage

Forged Stop

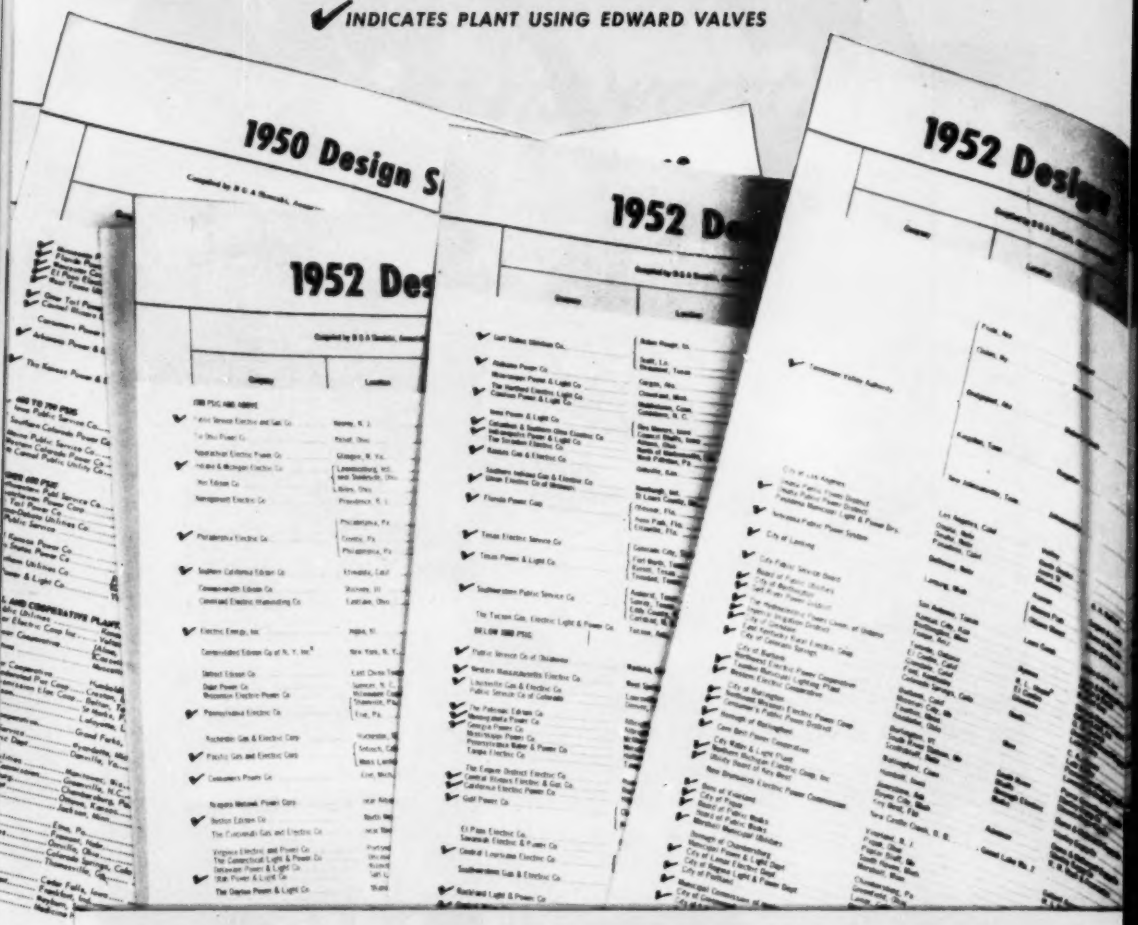
Blow-off

Forged Instrument

Forged Univalves

95% of new power plant projects

✔ INDICATES PLANT USING EDWARD VALVES



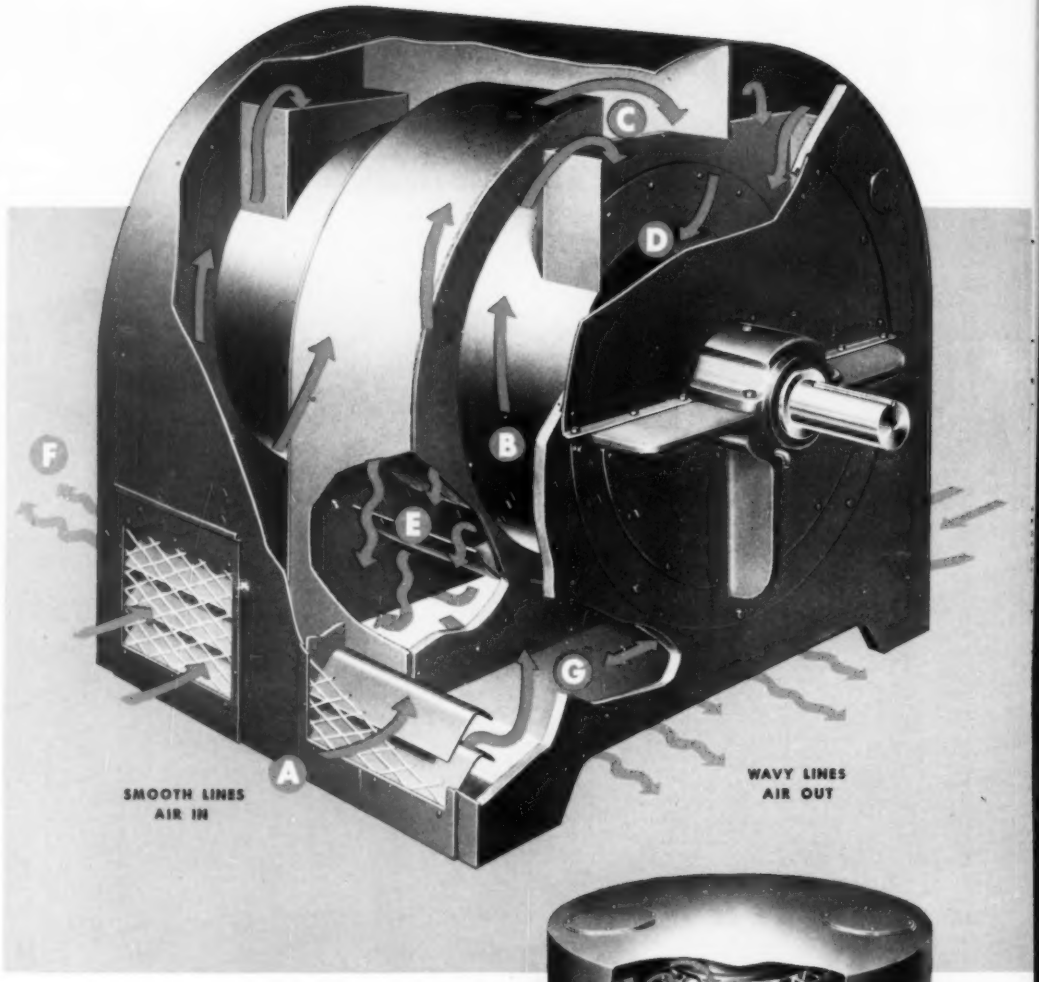
Edward builds the world's most complete line of steel power plant valves—gate, globe and angle stop, non-return, check, feedline stop-check, blow-off, Univalve, instrument, gage, hydraulic, relief valves and strainers for service from 150 to 7500 lb with bolted, screwed, welded or pressure-sealed bonnet connections and with flanged, screwed or welding end connections. Write for catalogs.

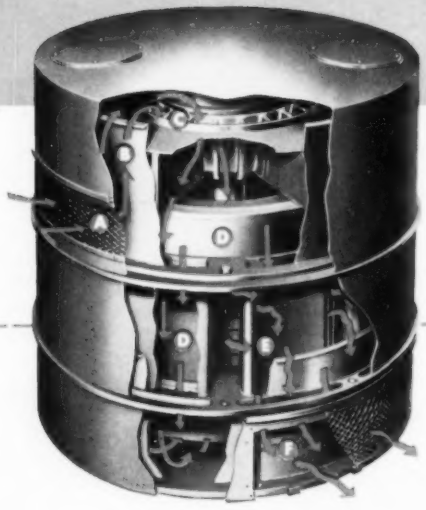
Edward Valves, Inc.

Subsidiary of ROCKWELL MANUFACTURING COMPANY

EAST CHICAGO, INDIANA

Another Product





VERTICAL OUTDOOR MOTOR

New Outdoor Motor

dares weather to do its worst!

You can install these induction motors outside—any place—and forget the weather. They're naturals for power station auxiliary service, in fact, any place where a motor must stand up to weather—wind, rain, or hail as long as the ventilated openings are unobstructed.

Look at the cutaway drawing at the left. You can see that the motor is completely enclosed by a steel shell. Note how air enters the shell at the bottom (A), flows up and around in the motor shell (B), to top (C), where it is drawn down and into the interior of the motor (D). Warm air is discharged from motor (E) and out enclosure ends (F).

Now, what happens when moisture, rain and sleet are present in the air? The air is drawn in at point (A). As the air rises at a slow velocity, water, sand and other heavier-than-air particles fall to base (G) where a drain carries them away. Result? Regardless of outside conditions, only clean dry air enters the motor.

For example: Sectional covers and air shields, easily removed by hand. Split bearing housings, with bearings readily accessible for inspection or replacement. Sturdy welded steel frame; stronger, lighter, smaller.

Also, vertical-type outdoor motors are available with features that have made Westinghouse motors leaders in industry.

Get the facts now for immediate use or with an eye toward future requirements. See your Westinghouse representative or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-10375

YOU CAN BE SURE...IF IT'S
Westinghouse
LARGE INDUCTION MOTORS

STRENGTH

for Safety and Long-Time Service

For 2000, 3000 and 6000 pounds service — Sizes 1/8" to 6"

SCREW END TYPE

For schedules 40, 80 and 160 pipe — Sizes 1/8" to 4"

SOCKET WELD TYPE

Vogt Ells, Tees, Crosses, etc., are forged from carbon steel or various alloys to meet specific operating conditions. Catalog F-9 will aid you in their selection and proper application.

Shocks and stresses imposed by high pressures and high temperatures are taken in their stride because Vogt fittings are uniform in structure, fine grained, and free from porosity . . . the superior product of laboratory controlled materials and giant forging hammers and upsetters. These properties also give higher resistance to erosive and corrosive conditions, thereby adding to service life expectancy in steam plants, petroleum refineries, chemical plants and related industries.

HENRY VOGT MACHINE CO., INC
Louisville 10, Kentucky
BRANCH OFFICES: NEW YORK • PHILADELPHIA • CLEVELAND • CHICAGO • DALLAS

Vogt DROP FORGED STEEL FITTINGS

Wins every time

You can't deal yourself a better hand than U.S. Security. It's the completely dependable tape for electrical or general-purpose jobs. Security has no pinholes to cause leaks, will not dry out. It has high-dielectric strength, is straight-tearing, non-ravelling, will never let you down. ALWAYS Specify U.S. Security.

U.S. Security *Rubber* Tape is unbeatable for perfect splicing when used with U.S. Security *Friction* Tape.

QUALITY PRODUCTS OF
U.S.RUBBER
SERVING THROUGH SCIENCE

UNITED STATES RUBBER COMPANY

TAPE DEPARTMENT • ROCKEFELLER CENTER, NEW YORK 20, N. Y.

here's how

NEW COAL HANDLING SYSTEM REDUCES COST

James F. Bransfield Co. Cuts Equipment Investment, Speeds Work with Versatile Allis-Chalmers Tractor and Front-End Shovel

ON COAL

STOCKPILES — HD-5G Tractor with Tracto-Shovel pushes coal wherever desired on stockpile. Traveling anywhere, it is more flexible than conveyor or bridge systems — lower cost, too.

COMPACTS — With added weight of fully loaded bucket, HD-5G compacts coal for safety from fire. Tight packing of thinly spread horizontal layers eliminates flues that often cause spontaneous combustion in loose conical piles.

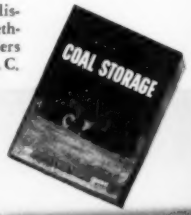
RECLAIMS — With 2-yd. bucket and 9-ft. dumping height, the HD-5G efficiently loads coal from stockpile to trucks for hauling to power plant. On short hauls it 'dozes or carries coal.

ON CINDERS

STOCKPILES cinders from power plant, placing piles wherever there is available space, without need for conveyors, tracks, etc. HD-5G works effectively either as 'dozer or loader in stockpiling.

LOADS THEM FAST — Owner supplies cinders to concrete contractors, finds handling them with the HD-5G faster and lower cost than the power shovel formerly used for this purpose.

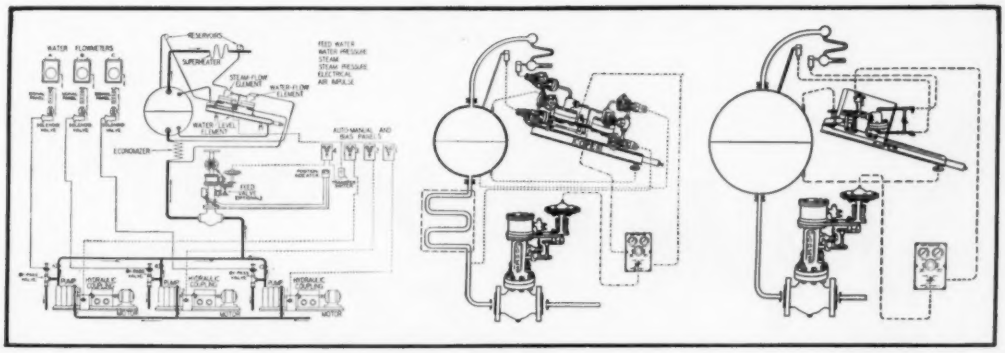
● Send for free booklet, "Economic Coal Storage with Allis-Chalmers Tractors." Describes modern coal-handling methods, using A-C tractors and 'dozer blades, front-end loaders and scrapers. Write Allis-Chalmers Tractor Division, Dept. C.



Tracto-Shovels are available for all four sizes of A-C tractors. Standard buckets 1 to 4 yd., coal-handling buckets 2 to 7 yd.

A-C tractors also provide additional return on your investment through use in plant or yard maintenance, car spotting, snow removal, dozens of other jobs.

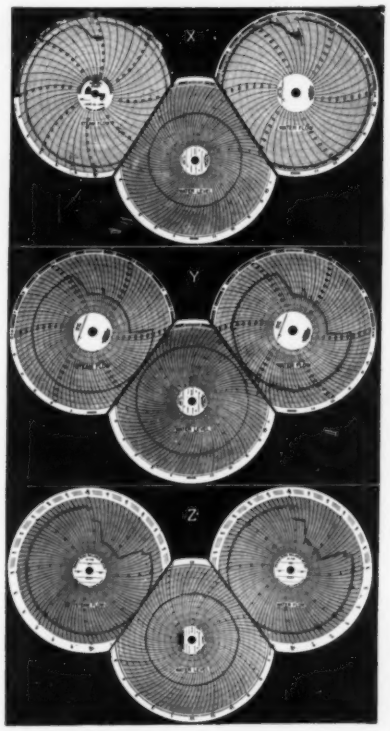
ALLIS-CHALMERS
TRACTOR DIVISION • MILWAUKEE 1, U. S. A.



"A"—COPES Balanced Flow (3-influence) Control applied to hydraulic couplings of three pumps feeding boiler. Minimum Flow Control System also shown.

"B"—COPES Balanced Flow Regulator feeds boiler according to balanced influences of water level, steam flow and feed water flow.

"C"—COPES Flowmatic Regulator, air operated, actuated by water level and steam flow. Most modern design of the original 2-element control.



Which Control System Produced Which Charts?

"X"—Steam-flow, water-flow and water-level charts for a C-E-S Steam Generator. Peak load capacity: 750,000 pounds per hour.

"Y"—Corresponding charts for a Babcock & Wilcox Radiant Type Boiler. Peak load capacity: 425,000 pounds per hour.

"Z"—Similar charts for a C-E-S Radiant-Type Steam Generator. Maximum evaporation: 1,150,000 pounds per hour.

Each of these three COPES Boiler Feed Control Systems is used in a different utility plant. Results with each system are shown by one set of charts. You'll find little difference in gearing of feed to steam output or water level stabilization, because COPES always designs for the individual operating conditions. The number of control influences is unimportant. Try matching Charts "X", "Y" and "Z" to the correct control systems—then mail the coupon. The first 25 to do so will receive a useful gift.

NORTHERN EQUIPMENT DIVISION
CONTINENTAL FOUNDRY & MACHINE COMPANY
ERIE, PENNSYLVANIA

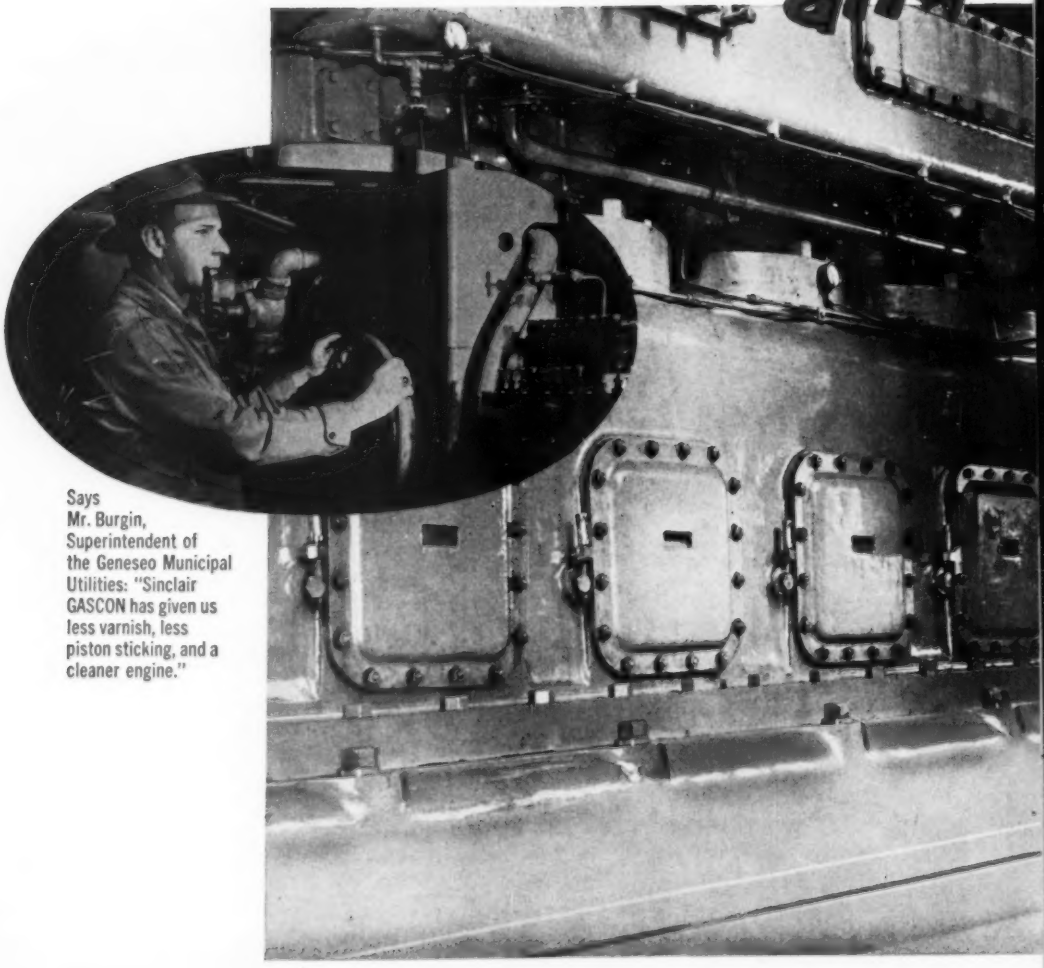
Here's how I'd match the charts and control systems:

Charts "X" were from the boiler with Control System ☐
Charts "Y" were from the boiler with Control System ☐
Charts "Z" were from the boiler with Control System ☐

NAME _____
POSITION _____
COMPANY _____
ADDRESS _____
CITY _____ STATE _____

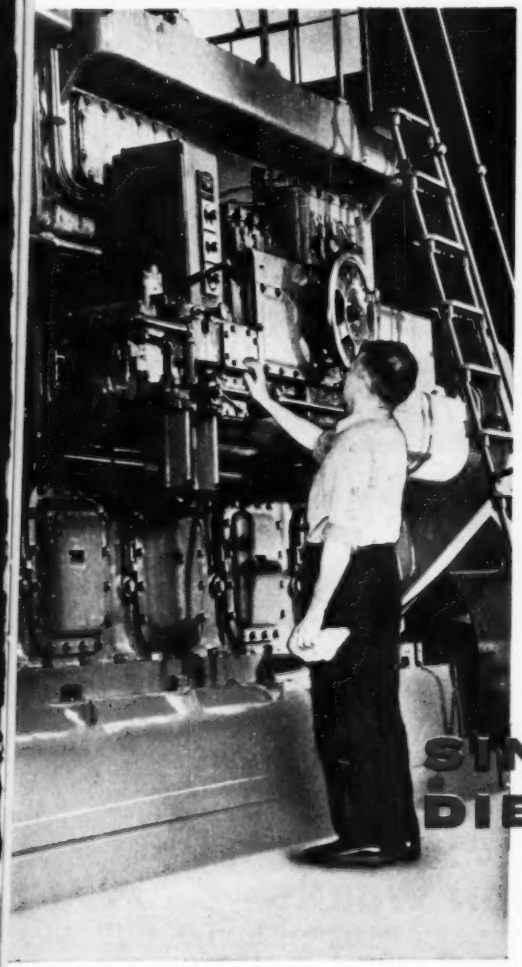
COPES
BOILER FEED
WATER REGULATION

Light Plant Solves Sticking and



Says Mr. Burgin, Superintendent of the Geneseo Municipal Utilities: "Sinclair GASCON has given us less varnish, less piston sticking, and a cleaner engine."

Problems Rings Carbon Build-Up!



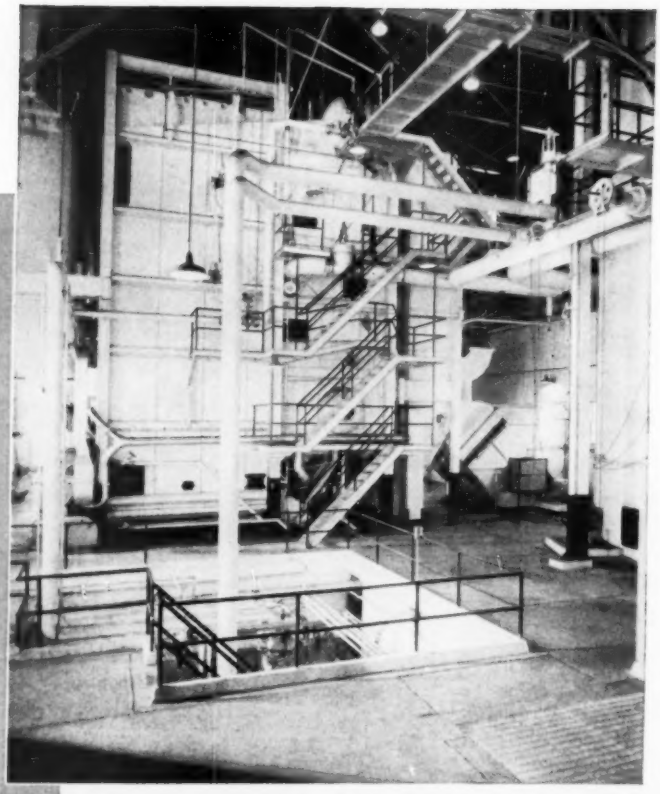
For quite some time the Light Plant of Geneseo Municipal Utilities, Geneseo, Ill., had trouble with sticking rings, and with carbon deposits in the exhaust ports of its diesels. A few years ago these diesels were changed over to Sinclair GASCON D. Almost at once, it was noted that the troublesome conditions started to clear up. In the time since, sticking rings have become the rare exception and the carbon deposits are no longer a problem.

Furthermore, in 1947, a 1400 hp. Fairbanks-Morse engine, shown at left, was installed and filled with GASCON D. This engine has never had a sticking ring and is running remarkably clean, with exceptionally low cylinder wear.

Perhaps GASCON® Oil can cure *your* diesel troubles, too. Get in touch with your nearest Sinclair Representative or write Sinclair Refining Company, 600 Fifth Ave., New York 20, N. Y.

SINCLAIR DIESEL OILS

prolong engine life



USER*
Sugar Refinery
BOILERS
2 Erie City 2-drum
CAPACITY
150,000 lbs./hr.
DESIGN PRESSURE
450 lbs.
OPERATING PRESSURE
410 lbs.
STEAM TEMPERATURE
570°F
TEMPERATURE OF FEED-WATER
250°F
SUPERHEATERS
Erie City
AIR HEATERS
Erie City
FIRING
Traveling Grate Spreaders
FUEL
Lignite 9000 B.t.u./lb. and Bituminous 11,500 B.t.u./lb.

* Name on request

Sweet Words From Sugar Specialists

Recently an official of this large sugar refinery wrote us:

"We are all very proud of this installation and know that our boilers will meet the high standard of efficiency set by Erie City Boilers. Your personnel should be complimented for the fine workmanship that went into these boilers and the efficient manner in which our order was handled and scheduled through your shop.—This indicates good teamwork in your organization."

Yes, it takes good teamwork by all parties concerned to build good boilers, so whatever your steam requirement consult Erie City, for you can depend on Erie City steam generating equipment.

ERIE CITY
112 Years in Steam Generation

ERIE CITY IRON WORKS • *Erie, Pa.*

STEAM GENERATORS • SUPERHEATERS • ECONOMIZERS • AIR PREHEATERS
UNDERFEED AND SPREADER STOKERS • PULVERIZERS

New Bulletin about the HAGAN RATIO TOTALIZER

This simple and versatile control mechanism, designed by Hagan Engineers, has wide application in pneumatic control circuits which include simple or complicated computing functions.

This new bulletin about the Hagan Ratio Totalizer and what it does, is yours for the asking.

for your copy, clip the coupon

HAGAN CORPORATION

RING BALANCE FLOW AND PRESSURE INSTRUMENTS
THRUSTORQ FORCE MEASURING DEVICES
BOILER COMBUSTION CONTROL SYSTEMS
METALLURGICAL FURNACE CONTROL SYSTEMS

Hagan Corporation
Hagan Building
Pittsburgh 30, Pennsylvania

Please send me a copy of the new bulletin about the Hagan Ratio Totalizer

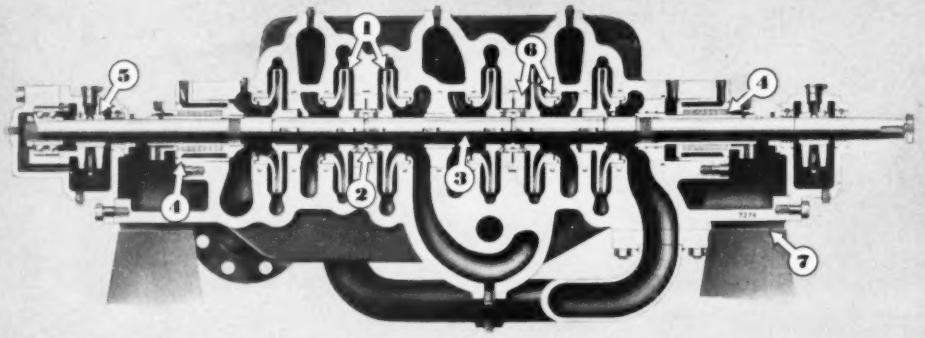
Name.....
Position.....
Company.....
Street and Number.....
City.....Zone.....State.....

PE-5

Simplicity, long life, easy maintenance

CAPACITIES TO 1000 GPM
PRESSURES TO 1200 PSI
TEMPERATURES TO 350-400F

1. Opposed impellers balance axial thrust.
2. Impeller mounting provides leak-proof shaft sealing between stages.
3. Exposed shaft insures freedom from distortion.
4. Removable stuffing boxes permit flexibility in shaft sealing arrangement.
5. Split sleeve radial bearings are standard.
6. Positive interstage wearing ring seals eliminate leakage.
7. Casing support insures coupling alignment.



You get them all with...

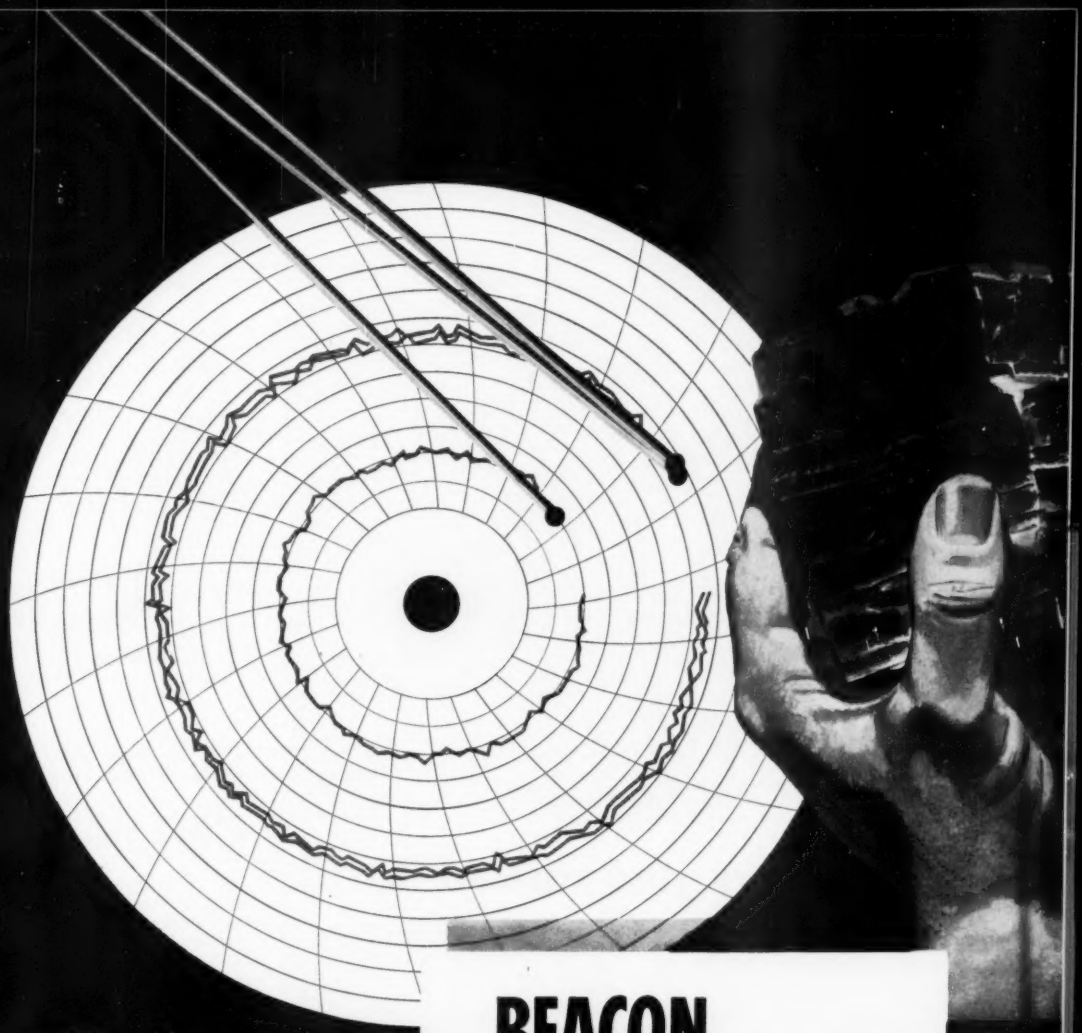
DE LAVAL
OPPELLER PUMPS

Look at the seven outstanding features shown in the cross-section and you'll see why De Laval Boiler Feed Pumps stay on the job for years...trim maintenance costs. Suitable materials are available for all water conditions. Write today for bulletin giving full application and specification data.

Boiler Feed Pumps

DE LAVAL STEAM TURBINE COMPANY
Trenton 2, New Jersey

DL 149



uniformly
responsive to

every heat and
power demand

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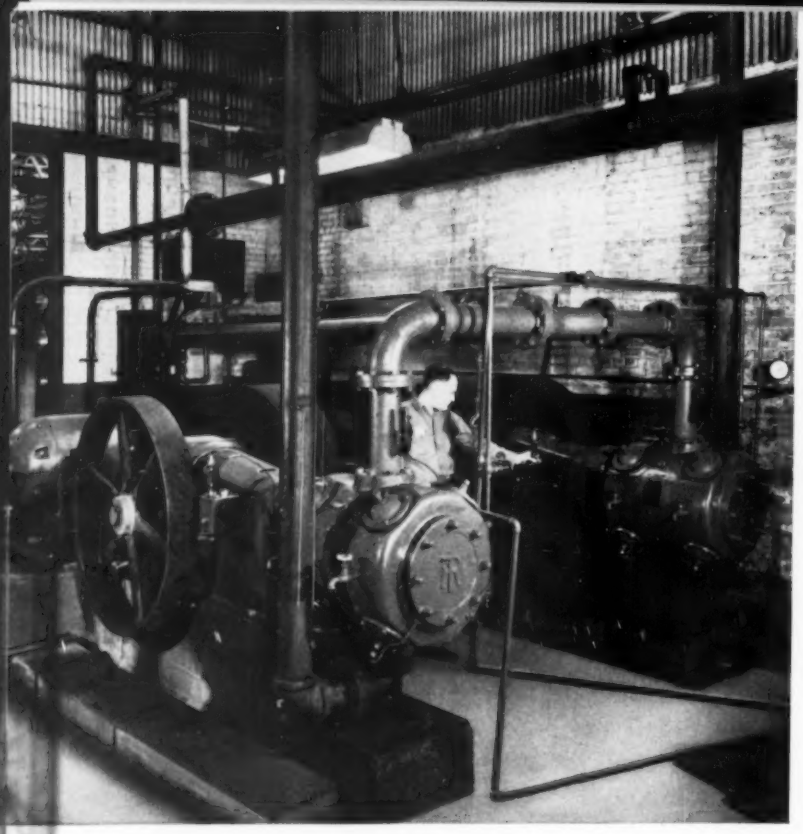
EASTERN GAS AND FUEL ASSOCIATES

PITTSBURGH • BOSTON • CHICAGO • CLEVELAND • DETROIT
NEW YORK • NORFOLK • PHILADELPHIA • SYRACUSE

For New England: New England Coal & Coke Co. For Export: Castner, Curran & Bullitt Inc.



Compressors give carbon the air

• When carbon formed on the valves of these air compressors and the oil in the crankcases had to be changed frequently, operators of this Midwest plant called in a Standard Oil lubrication specialist. He recommended STANOIL Industrial Oil, a multi-purpose oil having a low carbon-forming tendency and containing effective oxidation and corrosion inhibitors. With STANOIL, the compressors gave the air to carbon troubles and have breezed through four years of hard operation without difficulty. Over the oil previously used, STANOIL has given four times longer service in the crankcases. These results . . . similar to the results you may expect . . . have led to the use of STANOIL in other equipment in this plant.

STANOIL
TRADE MARK
Industrial Oil

Find how this multi-purpose oil can benefit you by discussing it with a Standard lubrication specialist. You can contact him by phoning your local Standard Oil office.

Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

Send for this booklet...

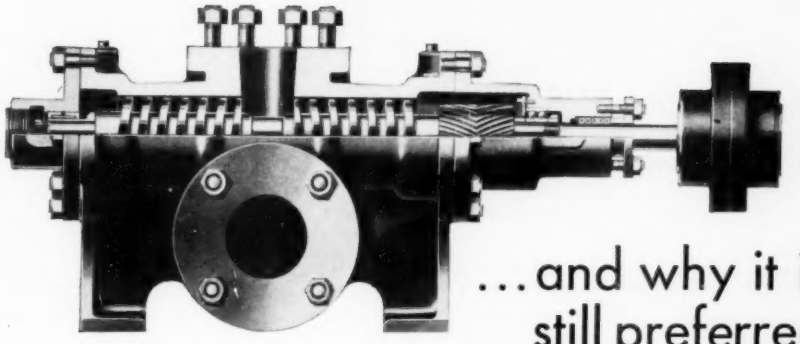
See what Stanoil offers you...

You'll find the means to significant savings in this booklet. It describes the important qualities of STANOIL Industrial Oil and the resultant benefits which have made this multi-purpose oil the choice of midwest manufacturers for a host of important lubricating jobs. Discover how STANOIL will give you superior protection through its unique combination of six outstanding characteristics, including high stability and effective rust prevention. Find how STANOIL can simplify stock, storage, and inventory in your plant by replacing special-purpose oils in hydraulic systems, speed reducers, air compressors, machine tools, electric motors, auxiliary turbines, and a wide variety of circulating, bath, and bearing systems. Ask the Standard Oil lubrication specialist from your nearby Standard Oil office for this booklet, or write: Standard Oil Company (Indiana), 910 S. Michigan Ave., Chicago.

STANDARD OIL COMPANY STANDARD *(Indiana)*

QUIMBY

...the Original Screw Pump



...and why it is still preferred

100% Anti-friction bearing equipped. Due to their rolling action and minimum lubricating requirements, anti-friction bearings maintain their original clearances without appreciable wear. No hydraulic shock or discharge pressure loads on the bearings because Warren-Quimby Screw Pumps are 100% balanced axially.

Quadruple non-slip screws. A specially generated curvature is now used, producing a straight line contour between screws, essentially eliminating all slippage between these elements. Closer clearances without metallic contact insure higher efficiencies over longer periods.

Balanced power, pulseless discharge. No special foundations or bolting required for successful operation. Smooth running and quiet, with a minimum of churning or foaming of liquid handled.

No stuffing box troubles. In general, there are no packing troubles with Warren-Quimby Screw Pumps. By using sets of opposed intermeshing pumping screws, the flow of liquid is from each end toward the center, insuring suction pressure only on the stuffing boxes.

Herringbone Driving Gears. Smoother flow of power from the driving shaft to the idler shaft is accomplished by multi-tooth, precision cut, full herringbone gears. These gears are so positioned and timed as to maintain a definite clearance between the pumping screw elements.

Positioning Bearing. A fixed ball or roller bearing on the drive shaft effectively absorbs all external thrust loads. This permits full floating screw elements, free to expand at elevated temperatures without harm to the pump.

Interchangeability. All parts, excepting the body and length of screws and shafts, are interchangeable with corresponding sizes in the gear-in-head and external bearing designs.

The most complete line of Screw Pumps in the industry.

Insist upon the original...now owned, manufactured, marketed, serviced and guaranteed by Warren . . . one of America's pioneers of the pump industry. Write for bulletin S-204.

PQ-1

WARREN QUIMBY PUMPS

WARREN PUMPS

WARREN STEAM PUMP COMPANY, INC., WARREN, MASSACHUSETTS

Equipment News

SUMMARIZED HERE are new products and improved ones . . . recent developments of leading manufacturers who will gladly supply further information at no cost. You may use the no-obligation, postage-free cards on page 127 for your request. Just list the numbers of the items you'd like to know more about

1—PROGRAM CONTROLLER

For automatically regulating feed of chlorine in chlorinizers

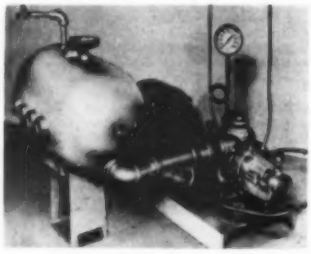
This automatic program controller is described as a simple and accurate device for controlling the feed of chlorine at predetermined rates for predetermined periods in identical cycles to meet variations in chlorine demand as they may occur. It consists of a simple, cam-operated pressure valve so arranged as to transmit varying pressures to the lower diaphragm pressure chamber of the chlorine control valve in a chlorinizer. Cams are interchangeable to meet many variables encountered in chlorine demand and usage.

Features announced for the new unit include accurate control, pneumatic or water operation, unlimited variety of programs. Major elements are self-contained in a dust-proof case for panel, wall or floor stand mounting. Builders-Providence, Inc.

2—CLOSED RETURN SYSTEM

Is designed to return hot condensate back to boiler

Highly effective savings of heat are claimed possible with this new return system. According to manufacturer, the



only heat loss in the system is that actually used in the steam-heated unit. With 20 different size pumps available for a range of requirements, this system is intended to handle volumes from 3300 to 33,000 lb of condensate per hour. Five pressure ranges from 25 to 150 psi are available. Stansbury Engineering & Sales.

3—SECTIONALIZER

Is designed to permit load pick up after long power outages

The Type LPS is a load pickup sectionalizer which, when used in connection with reclosing circuit breakers or reclosers, enables distribution circuits to be picked up after power outages without manual operations normally required. According to company, it automatically compensates for the power demand that accumulates during an outage. If the accumulation is enough to cause reclosing circuit breakers to operate, the sectionalizer temporarily disconnects part of the load. The load is reconnected after a predetermined time delay by a self-contained timing relay. This time delay is a function of the outage duration but has an adjustable maximum value.

Under fault conditions, the unit works as a conventional automatic line sectionalizer; it can also serve as a manual load break switch. It is contained in a galvanized steel tank with cast-iron cover casting that supports 15-kv line bushings. Series coils can be had in ratings from five to 100 amp. Control relay voltage can be 110 or 220 v a-c. Westinghouse Electric Corp.

4—COMBINATION BURNER

For oil or gas, is offered to cope with seasonal fuel shortages

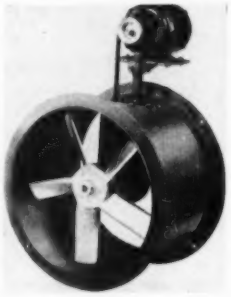
This new burner, available for all of company's Thermobloc industrial type forced warm air direct-fired heaters, is designed to permit instantaneous changeover from oil to gas or gas to oil. No piping changes or burner changes are required, and the changeover may be automatic or by manual pushbutton. In effect, the burner operates for the greater part of the heating season on the most economical fuel available.

According to company, these combination burners are being extensively installed in many areas where users enjoy "dump load" rates. Limited gas supplies in these areas ruled out new straight gas heating installations, but gas companies permitted installations in which the gas could be shut off at any time without imposing a hardship on the user. Thermobloc Div., Prat-Daniel Corp.

6—IMPROVED EXHAUST FAN

Is developed for eliminating hazardous fumes and vapors

For exhausting dangerous or obnoxious fumes, dirt, heat and smoke and other applications where it is desirable to have the motor outside the air stream,



this manufacturer offers a general-purpose fan combining several improvements. Explosion-proof, enclosed or open type motors are available as required, company says, and the unit meets Underwriters' Laboratories' specifications for spray booths.

Features of the new fan include sealed SKF bearings in replaceable flange con-

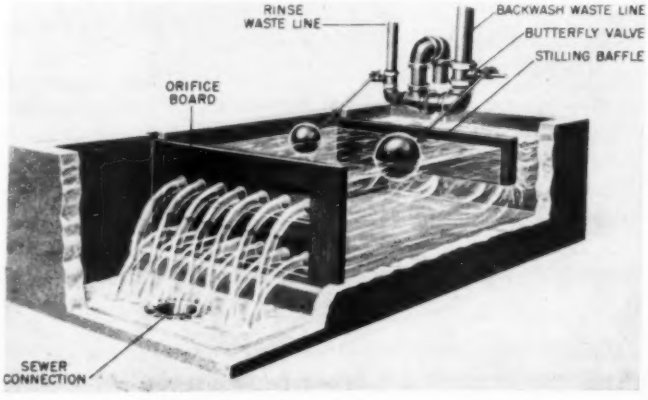
5—WASH AND RINSE CONTROLLER

Is designed to conform with state and local laws against back-siphonage

The new Anti-Back-Siphonage Wash and Rinse Controller is intended to prevent excessive rates of flow during backwashing or rinsing and to eliminate possibility of back-siphonage of waste water. This arrangement is standard on company's sodium zeolite softeners of 54 in. dia or larger and can be provided for hydrogen zeolite, anion exchange, and pressure type filter equipment when required.

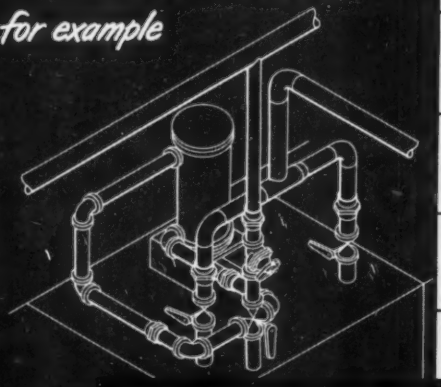
Water flows at a constant rate through orifices of fixed size, under a constant head maintained by a float-operated butterfly valve. Thus, company points out, greater than normal pressure does not affect the rate of flow.

The waste water discharge line terminates at a minimum distance of 6 in. above sump rim to provide a positive air gap. It acts to prevent backflow of water from the sump in the event that negative pressure should occur in the supply system. The Permutit Co.



Are Your Valves Behaving This Well?

...on River Water, for example



THE INSTALLATION

Crane Iron Body Diaphragm Valves on hydraulic lines to cylinder operators on ash pit gates; Southwark Station; Philadelphia Electric Company.

VALVE SERVICE RATINGS

SUITABILITY:	Good design for gritty fluid
FEATURES:	Neoprene disc insert resists cutting
MAINTENANCE COST:	Making big savings here
SERVICE LIFE:	Already 6 to 9 times longer than other valves
CORROSION-RESISTANCE:	O.K. No sign of corrosion
PRICE:	Better than many ordinary valves
AVAILABILITY:	Regular number in Crane line

THE HISTORY

Valves were installed in the hydraulic system when the control cocks failed to shut off tight. But like the cocks, conventional valves put in this service didn't stand up. They couldn't handle the abrasive, sandy river water used for hydraulic operators as well as for ash pit sluicing. They leaked badly in 3 to 5 weeks; had to be replaced.

The problem was solved with Crane Iron Body Diaphragm Valves. Installed more than 7 months, there's been no leakage since; no valve trouble of any kind. The Neoprene disc insert and wide, flat seating surfaces in Crane Valves show no effect of abrasion. Their completely sealed bonnet keeps working parts free of grit.

THE VALVE

In Crane Packless Iron Body Diaphragm Valves, the Neoprene diaphragm acts as bonnet seal only; is not subject to crushing and rapid wear. Separate disc with Neoprene insert shuts off flow even should diaphragm fail. Made unlined or with full Neoprene body lining. Well suited for erosive fluids, sludges, slurries; also for many corrosive services. See your Crane Catalog or call your Crane Representative.

The Complete Crane Line Meets All Valve Needs. That's Why

More Crane Valves Are Used Than Any Other Make!

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois

Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

struction, double angle motor support to minimize vibration, adjustable motor base for belt take-up and cast aluminum fan blade in sizes from 18 to 42 in. Motors range from ¼ to 7½ hp. Standard Electric Mfg. Co., Inc.

7—GATE VALVE

All purpose type, for full, unobstructed service flow

The No. 90 Bronze Solder End Gate Valve is announced as ideal for hot and cold water lines or low pressure steam

—in plumbing, heating and air conditioning systems. Company says it has a sturdy, amply-sectioned body that won't distort and its seat won't warp under soldering temperatures. It is intended for use with K, L and M copper tubing. Working pressures are steam, 125 lb, and cold water, oil, gas (non-shocking), 200 lb. Reading-Pratt & Cady Div., American Chain & Cable Co., Inc.

8—SOLID CARBIDE SAW

New hub type, for commutator undercutting, other jobs

Although designed primarily for commutator undercutting, this saw can be used on other slitting and slotting work. Its principal design feature is a brazed ring which forms a part of the hub to make the hub and solid carbide blade completely bonded and rigid. Longer tool life and less tool breakage are reported from its use. Diameters of the new saw range up to 3 in. Gay-Lee Co.

9—RATCHET TYPE RELAY

Is constructed with automatic stop feature to prevent slippage

The newly developed AP Impulse Relay has an automatic stop to prevent slippage or overtravel of ratchet and insure precise action on each impulse. It is said to be capable of high speed operation with a contact transfer time as short as 20 milliseconds.

Standard units are available up to 230 v, a-c or d-c, and contact combinations to 4-pole double throw. Contacts are 3/16 in. dia fine silver, rated at 5 amp, 115 v a-c non-inductive load. Size is 2⅛ in. wide by 4 in. long by 2¼ in. high. Potter & Brumfield.

Use post cards on page 127 to ask for more information on any of these products

10—POTENTIAL TRANSFORMER

In the 2400-v class, in types for indoor and outdoor use

The Types PT and PTO Transformers are made with a new crepe paper insulation that is vacuum dried and impregnated and provides high impulse and dielectric strength and low insulation power factor. They are available in either 45- or 60- kv full-wave impulse test level, company points out, and meet the 0.3W, 0.3X, 0.3Y and 1.2Z metering accuracy classifications.

Improved in appearance, this transformer is mounted in a single-piece, steel case with welded-on base. It utilizes new HV bushings mounted without bushing flanges. Single and double HV bushing combinations are available on the cover or at end of case. Cover-mounted bushings only can be supplied with or without Type BAL high voltage fuses. The outdoor type is available with cover-mounted bushings only, without fuses. Westinghouse Electric Corp.

11—FLARING TOOL

Is designed to provide automatic burnishing of the flare face

The 500-F Rol-Air is for flaring soft copper, steel, aluminum and brass tubing, making 45 deg flares on 3/16 to ⅝ in. OD tubing for standard SAE flared fitting joints. The automatic burnishing action is provided through the use of a lost motion mechanism in the yoke which disengages the feed during the first revolution when backing off the cone. This causes the cone to burnish the flare and give it a polished finish. The cone is hardened steel, multi-faced type, with tool chrome finish.

In this tool the flare is formed in the air above the flaring bar instead of against a bevel in the bar. This is said to maintain original wall thickness of the tubing at the base of the flare and result in stronger flares. Full information about the tool is provided in Bulletin 3003. The Imperial Brass Mfg. Co.

12—CONDUCTIVE DEVICE

Is worn over shoe to protect against static electricity

The Conductive Bootie is made of cotton sail cloth with conductive sole applied. Skin-to-floor contact is maintained by means of chain which connects the conductive sole with a metal

plate worn in an elastic garter around calf of the leg, or on the flexible conductive band at the top of the Bootie. Tested to 250,000 ohms resistance, the resistor unit is claimed to offer protection sufficient to withstand direct contact with a live wire or short circuit.

Manufacturer of this device stresses its economy, since it doesn't require individual fitting and will be sold for about half the cost of conductive shoes. It comes in small, medium and large sizes, for men and women. Sterilization after wearing affords sanitary protection and safeguards soles from adherence of insulating wax deposits. Bootie is described as light in weight, comfortable to wear, and durable. Walter G. Legge Co.

13—AIR CONDITIONERS

Medium tonnage sizes, have integral evaporative condensers

Designed to meet stringent municipal regulations on water consumption and disposal these new self-contained units will be produced in 15 and 20 t capacities, and are intended to meet year-round air conditioning requirements, delivering conditioned air through a

duct system. Their "water saving" feature is credited to the use of company's multi-step reciprocating compressor which is designed to step down power consumption automatically when less cooling is required.

The compressor, evaporative condenser and air conditioner assemblies are grouped into a compact cabinet and the unit shipped completely wired, piped, dehydrated, charged and tested for operating conditions of the job. The Trane Co.

14—FEEDWATER SYSTEM

Is made up of four kits which may be purchased separately

York-Power Feedwater Systems, for industrial boilers, can be had as complete systems or in separate kits for specific jobs. The four kits include make-up assembly, heater assembly, receiver assembly and complete pump assembly. They are made for use with company's Steam-Pak Generators but are designed to handle any type of condensate return problem. They are described as compact, flexible units that automatically supply hot make-up water for boiler operation and operate efficiently with any type of steam boiler, reclaiming both high and low pressure condensate and maintaining a constant uniform water temperature.

Pump set assemblies are available for 100, 125 and 150 psi and for boilers from 15 to 300 hp. Capacity of the receiver assembly ranges from 30 to 450 gal. Heater assemblies are available in eight sizes from ½ to 2 in. capacity. Six sizes from ½ to 2 in. are available.

Boiler feedwater is made up in the receiver tank from the condensate re-

The hard, cold facts about Pittsburgh's hot furnaces!

47 PLANTS OKAY THE HEAT PROVER

Pittsburgh's great steel industry needed an instrument to measure air infiltration, to check air requirement and fuel-air ratio controls in open-hearth furnaces . . . an instrument to check the stoves in which blast-furnace air is heated . . . to check precise atmospheres in soaking pits . . . to control fuel waste and precise atmospheres in processing furnaces.

THE CITIES SERVICE HEAT PROVER WAS THE ANSWER . . . and it received the stamp of approval from engineers in 47 different mills in and around Pittsburgh!

Cities Service Heat Provers . . . *not an instrument you buy, but a service we supply* . . . helped to boost furnace productivity through these five unique advantages:

1. Rapid continuous sampling.

2. Simultaneous reading of oxygen and combustibles.

3. Direct measurement of oxygen and combustibles.

4. Easy portability.

5. No maintenance; no re-calibration.

These points begin to tell you why Cities Service Heat Prover analyses are just as much favored in glass, ceramics, steam generation and other fields as in the great Pittsburgh steel area. For the full story as it applies to you, write CITIES SERVICE OIL COMPANY, Dept. F23, Sixty Wall Tower, New York City 5.

CITIES SERVICE

turn and city water. Condensate from the system returns to the receiver by gravity. If condensate returns are not great enough to maintain proper level, the float will drop down closing the switch which will complete a circuit and open a solenoid valve on the make-up line, admitting city water. When proper level is reached the switch will open causing the solenoid valve to close. York-Shipley, Inc.

15—PLASTIC PIPE

For water service, suction and higher pressure lines

WS Plastic Pipe is intended to provide long corrosion-free service life under severe operating conditions. Similar to company's EF Pipe, this new type has increased wall thickness for protection against burst or collapse when handling higher working pressures or operating in a suction line.

The Type WS features flexibility, light weight and resistance to rot, rust and electrolytic corrosion. Its smooth internal surface won't accumulate scale or sediment, company says, recommending its use for municipal service connections, in sand and gravel pits, natural gas transmission and similar uses.

No special tools or rigging are required for installing this pipe and it can be curved to follow irregular contours. Plastic-to-plastic or plastic-to metal connections can be made with molded plastic fittings. Pipe comes in nine sizes from ¾ to 6 in. Working pressure is 120 psi at 120 F in sizes to 1½ in., slightly less in the larger sizes. Carlon Products Corp.

16—WATER TESTER

Utilizes soap test to signal the end of a zeolite softener run

The Hydramizer takes a sample of the water and makes a soap test. If the water is hard a red light appears; if it is soft a green light glows. For automatic softeners, it is designed to actuate the automatic valves, and for selective automatic or manual units it will ring a bell to warn the operator that regeneration is necessary. Compact in size, the Hydramizer can be placed anywhere on a stand or shelf near the softener. Refinite Corp.

18—MASONRY COATING

Is one-coat oil base paint for both appearance and protection

Mason Coat No. 310 is designed for the two-fold purpose of decoration and protection against moisture infiltration. It is applicable to both interior and exterior surfaces of concrete block, cement, brick, stucco, asbestos cement siding and similar masonry surfaces. It may be applied by brush or spray over new or previously painted masonry surfaces, and being elastic, it withstands weather and temperature changes. Company says it has excellent hiding qualities and its one-coat feature makes it economical. Comes in white and several tints. United Laboratories, Inc.

19—SHUNT FLOW METER

Is improved unit for measuring steam, air or gas

The Model SMKS Shuntflo Meter has been redesigned to incorporate several improvements. They include a streamlined damping chamber to facilitate a more uniform cooling system; an all Meehanite body casting; a more simplified rotor mechanism, and a strengthened rotor shaft to withstand slugs of undue condensate in the line or sudden fluctuations in line pressure. Builders-Providence, Inc.

Want more details on new products? Use those handy post cards on page 127

20—SPEED REDUCER

Double-reduction type, shaft mounted, with capacity to 43 hp

The new No. 7 Torque-Arm Speed Reducer, for output speeds from 12 to 110 rpm, is said to have 59 per cent greater horsepower capacity than company's No. 6 model, while embodying the same advantages. It is shaft-mounted and anchored with a torque-arm which fastens to any fixed object. A turnbuckle is provided for quick, easy adjustment of belt tension. Dodge Mfg. Corp.

21—V-LINK BELT

Detachable type, is pre-stretched to prevent distortion after use

Although it is engineered not to slip or run in either direction, this new detachable V-link belt costs no more than

many V-Link belts now in use, according to manufacturer, and it incorporates features that permit smooth service at high speeds in either direction.

The links contain more plies, are uniform in camber and dimension, and made from tough woven cloth impregnated with top grade heat- and oil-resistant crude rubber. The non-slip feature is credited to high coefficient of friction and a perfected wedge action. Four reels of this belting are intended to replace 315 standard sizes of endless V-velts. Brammer Co.

22—VOLT-AMMETER

Pocket size, offers six ammeter and three volt-ammeter ranges

Like its predecessors, the new Model 600 Amprobe is a snap-around unit for measuring current instantly without interrupting the circuit or shutting down equipment. Ranges are: 0–15/30/60/150/300/600 amp a-c, and 0–150/300/600 v a-c.

Engineering and design advancements announced for the Amprobe 600 include a doughnut-type transformer to practically eliminate factor of error due to position of conductor within probe jaws; nine-range fingertip selection; insulated probe jaws, and voltage test lead plug automatically insulated by snap-out sleeve when removed from meter. The price is $59.50 including leather case and voltage test leads. Descriptive material is available. Pyramid Instrument Corp.

23—RENEWABLE FUSES

Are redesigned to incorporate large area heat dissipating fins

Several sizes of this manufacturer's well known renewable knife blade type fuses are now made with six brass fins. They are designed with three fins spaced equally along each end of the fiber bar support. Because of the greatly increased heat transfer surface, the interior of the fuses remain cooler, company points out. The fins also act to keep heat away from the fiber bar and thus maintain internal strength for accurate alignment, and they give support to the bar. The new design is featured in the 600 amp-250 v and the 400 and 600 amp-600 v fuses. They are described in Bulletin 25. Monarch Fuse Co., Ltd.

17—IMPROVED TRANSFORMERS

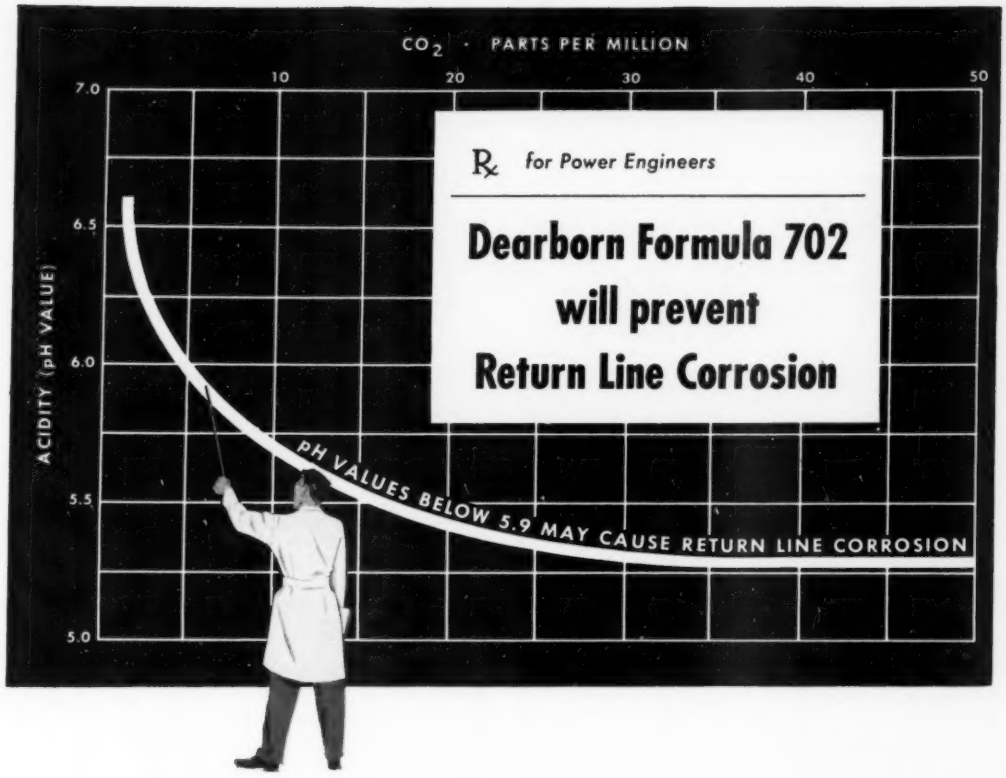
Are compact units, with high voltage tank wall bushings

These new distribution transformers have high-voltage, tank-wall bushings, instead of high-voltage pocket-type bushings: Company says they have smaller dimensions, an improved gasket seal for oil tightness, and better electrical characteristics than previous models with pocket-type bushings. The new type transformer is shown in the left of the picture, along with a unit of the old design.

An insulated screw cap on the bushing of the new transformer lets linemen make electrical connections without tools, and the cap is constructed so it won't fall off. Arrangement of the slots in the porcelain allows a conductor to be brought in on either side of the bushing.

The changeover applies to company's Type HS and unit Type HSBA Transformers of 5000 v and below, 100 kva and below. Production of the new type has already begun in some ratings and

other ratings will be added as soon as possible. Distribution Transformer Department, General Electric Co.



What's the pH value of your boiler feed water? Chances are that if it's 5.9 or lower, you have return line corrosion—caused by excessive quantities of dissolved carbon dioxide and oxygen.

Corrosion caused by a low pH is effectively prevented with Dearborn Formula 702. This effective Dearborn treatment, which is introduced directly into the boiler feed water, works three ways. First, it forms a continuous amine film on the return lines to prevent corrosion. Second, this same film improves heat transfer, thus lowering the cost of steam production. Third, Formula 702 will automatically repair the film broken by rust scale separating from the pipe.

It will pay you to learn more about how Formula 702 will reduce excessive maintenance, avoid shutdowns, protect valuable equipment. Why not call your Dearborn Engineer today?

DEARBORN CHEMICAL COMPANY

Merchandise Mart Plaza • Chicago 54, Illinois

BASIC PATENTS

Dearborn holds the basic patents (U.S. Pat. 2400543) for the use of filming amines for treating water.

YOU'LL WANT A COPY OF THIS BULLETIN

Bulletin 5013, which outlines the causes of return line corrosion and the method of cure with Formula 702, will be sent on request.

Dearborn Chemical Company, Dept. P.G.
Merchandise Mart Plaza
Chicago 54, Ill.

☐ Send a copy of Bulletin 5013
☐ Have a Dearborn Sales Engineer call

Name.....

Company.....

Position.....

Address.....

City.....*Zone*.....*State*.....

Dearborn

TRADE MARK REGISTERED

THE LEADER IN WATER TREATMENT AND RUST PREVENTIVES

POWER PLANT Construction News

Batesville, Ark. — Westmoreland Manganese Corp., Johnstown, Pa., plans power house at proposed new manganese beneficiating plant near Batesville, comprising several large units, equipped for heavy output. Entire project will represent a reported investment of about $4,000,000. Work is scheduled to begin at early date.

Glenwood, Ark. — Indianapolis Glove Co., 430 Park St., Indianapolis, Ind., plans boiler house at proposed new work-glove manufacturing plant at Glenwood, where site has been secured. Entire project is reported to cost close to $500,000. Glenwood Foundation, Glenwood, recently organized, is active in program.

El Segundo, Calif. — Douglas Aircraft Co., Inc., 827 Lapham St., has plans for new boiler house, 31 x 108 ft, at local airplane plant, with installation to include three boilers, air compressors, switchgear and other anxiliary equipment. No estimate of cost announced. Proposed to begin work at early date. J. E. Owens, company engineer, in charge.

San Francisco, Calif. — General Chemical Division, Allied Chemical & Dye Corp., 235 Montgomery St., San Francisco, plans steam power house at new chemical plant near San Francisco, for production of aluminum fluoride. It will comprise several large units. Cost reported close to $2,500,000. Work will proceed at once. Main offices of company are at 40 Rector St., New York, N. Y.

San Francisco, Calif. — Pacific Gas & Electric Co., 245 Market St., plans two new hydroelectric power plants as part of Pit River hydroelectric development in Shasta County. Stations will be known as Pit Nos. 4 and 6, respectively, and are estimated to cost $45,000,000. First noted will have a rating of 84,000 kw, and will represent a cost of $25,000,000 of amount noted; proposed to begin work early in July and to have plant ready for operation in 1955. Pit No. 6 station will have a capacity of 60,000 kw, and will cost approximately $20,000,000 of gross sum noted. It will require about 36 months for completion. Application for permission to proceed with project has been made to Federal Power Commission, Washington, D. C.

Santa Ana, Calif. — United States Rubber Co., 5675 Anaheim Blvd., Los Angeles, Calif., plans steam power house at proposed new plant at Santa Ana, where large tract of land has been selected. It will comprise a main one-story building, and several auxiliary structures, totaling about 170,000 sq ft floor space. Cost reported over $1,000,000. Main Offices are at 1230 Avenue of the Americas, New York, N. Y.

Ellijay, Ga. — Peerless Textiles, Inc., Cleveland, Tenn., woolen goods, blankets, etc., plans boiler plant at proposed new mill at Ellijay. It will comprise four main mill buildings, totaling about 192,000 sq ft floor space. Entire project will represent a reported investment of about $4,000,000. Construction will begin in near future.

Priest River, Idaho — Seattle District, U. S. Army, Corps of Engineers, 4735 East Marginal Way, Seattle, Wash., has approved construction of a new hydroelectric generating plant on Pend Orielle River branch, Bonner County, near Priest River, forming part of Albeni Falls project. Cost estimated $8,600,000. Work will begin at early date and will require about 24 months for completion.

Boone, Iowa — Iowa Power & Light Co., Cedar Rapids, Iowa, plans extensions and improvements in steam-electric power plant at Boone, reported to cost over $450,000, with equipment. H. R. Greene Co., 417 First Ave., S.E., Cedar Rapids, is consulting engineer.

Eddyville, Iowa — Iowa Southern Utilities Co., Centerville, Iowa, has begun work on superstructure for proposed new steam-electric generating station at Eddyville, to be equipped for a rated capacity of 44,300 kw. Cost estimated about $8,750,000. Completion is scheduled early in 1953, as previously noted in these columns. Pioneer Service & Engineering Co., 231 South LaSalle St., Chicago, Ill., is consulting engineer.

Kansas City, Kan. — Bd. of Public Utilities, 6th St. and Ann Ave., has approved plans for new addition to municipal power plant, to cost approximately $935,000, exclusive of equipment, and will proceed with work at early date.

Parsons, Kan. — Kansas Gas & Electric Co., Wichita, Kan., plans expansion in Neosho steam-electric power plant at Parsons, with installation of new turbine-generator unit, high-pressure boilers and auxiliary equipment for large increase in present capacity. Entire project is reported to cost close to $10,000,000. It is understood that work will begin this year.

Winchester, Ky. — Sylvania Electric Products Co., 1740 Broadway, New York, N. Y., plans power house at proposed new branch plant at Winchester, for manufacture of electric light bulbs. A tract of about 25 acres of land has been selected. It will comprise several large structures for production, and is estimated to cost approximately $4,000,000. Work is expected to begin in summer.

North Weymouth, Mass. — Boston Edison Co., 39 Boylston St., Boston, Mass., has approved plans for addition to generating station at North Weymouth, with installation of a new turbine-generating unit and auxiliary equipment. Contract has been let for structural steel framing and work on superstructure will begin during summer. No official estimate of cost announced.

Detroit, Mich. — Hudson Motor Car Co., 12601 East Jefferson St., has approved plans for new steam power house at local plant, with installation of high-pressure boilers and auxiliary equipment. Cost reported about $400,000. Construction scheduled to be carried out at once.

River Rouge, Mich. — Ford Motor Co., Dearborn, Mich, has authorized plans for extensions and improvements in No. 1 power plant at local works, with installation of three new high-pressure boilers, each with rating of 600,000 lb per hr, to replace present smaller units, and other equipment. Cost reported close to $7,500,000. It is expected to begin work in fall and to have plant ready for service in March 1953. Kuljian Corp., 1200 North Broad St., Philadelphia, Pa., is consulting engineer.

White Plains, Mich. — Copper Range Co., 24 Federal St., Boston, Mass., plans steam-generating station in connection with new metallurgical plant at White Plains, where copper-mining properties are being developed. A new townsite will be established for employes at plant. Entire project will represent a reported cost of about $57,000,000. Stone & Webster Engineering Corp., 49 Federal St., Boston, Mass., is consulting engineer.

Egg Harbor City, N. J. — Lenox Incorporated, Mead St., Trenton, N. J., dinnerware, will build a steam power house at new pottery on Tilton Rd., near Egg Harbor City, where tract of about 50 acres of land has been purchased. It will consist of a main one-story building, 200 x 700 ft, and several smaller units. Work scheduled to proceed at once. Entire project is reported to cost about $2,500,000.

New Brunswick, N. J. — U. S. Envelope Co., 21 Cypress St., Springfield, Mass., commercial and other envelopes, etc., plans boiler house at proposed new factory in Raritan Township, near New Brunswick, where large tract of land has been acquired. Cost reported close to $500,000. Work will be carried out soon.

New York, N. Y. — Consolidated Edison Co., 4 Irving Pl., has plans for installation of smoke control equipment at its local Hell Gate, Waterside and East River steam-electric generating stations, estimated to cost about $3,700,000, and will carry out work soon. Project has been approved by Defense Production Administration, Washington, D. C.

New York, N. Y. — West Penn Electric Co., 50 Broad St., operating Potomac Edison Co., Hagerstown, Md., and West Penn Power Co., Pittsburgh, Pa., has authorized fund of about $47,000,000 for expansion and improvements in plants and systems of utility companies noted in 1952, including extensions in generating capacity, power substations, transmission lines and other operating facilities.

Sulphur, Okla. — Oklahoma Gas & Electric Co., Oklahoma City, has plans maturing for new steam-electric generating station near Sulphur, with initial capacity of 100,000 kw, and will begin work soon. Cost estimated about $8,500,000, with power substations, transmission lines, etc. Pioneer Service & Engineering Co., 231 South LaSalle St., Chicago, Ill., is engineer.

Pinopolis, S. C. — South Carolina Public Service Authority, Moncks Corner, S. C., has plans maturing for new steam-electric generating station near Pinopolis, to be equipped for an initial rating of 96,000 kw. Work on superstructure will be placed under way in near future. No official estimate of cost announced. Ford, Bacon & Davis, Inc., 39 Broadway, New York, N. Y., is consulting engineer.

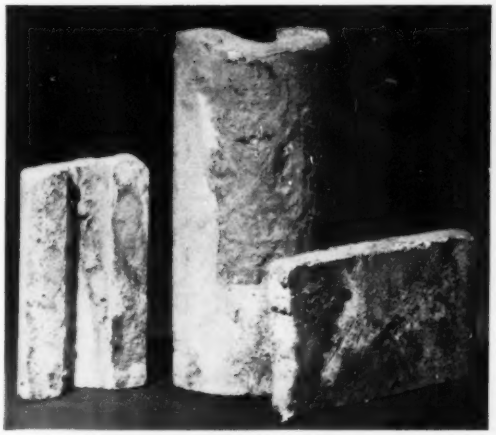
Goodwin, Tenn. — Shea Chemical Corp., recently organized, care of W. M. White Construction Co., Columbia, Tenn., plans steam power plant at new chemical works on local site, comprising several production units. Entire project is reported to cost about $3,000,000. Work will begin soon. Vincent H. Shea is president.

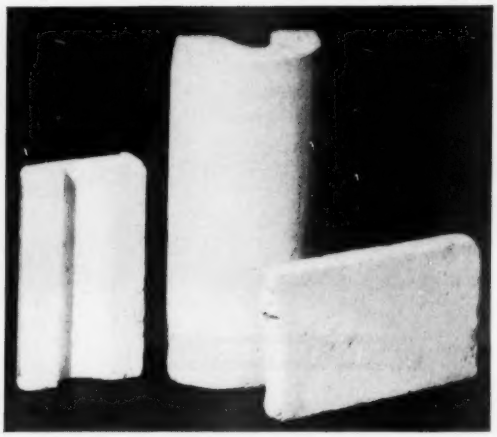
Garland, Tex. — DeSoto Paint & Varnish Co., 752 South Somerville St., Memphis, Tenn., paints, oils, varnishes, etc., plans boiler plant at new one-, two- and three-story factory at Garland, totaling close to 100,000 sq ft floor space. Entire project will cost about $1,000,000. Work will be carried out soon. Frank T. Tobey, Falls Bldg., Memphis, is engineer.

Paris, Tex. — Proposed new steam-electric generating plant of Texas Power & Light Co., Interurban Bldg., Dallas, Tex., recently noted in these columns, will be located on Crese River, vicinity of Paris. It will be equipped for an initial capacity of 80,000 kw, and will be known as Crese River Plant. Cost reported over $4,500,000. Proposed to begin work in near future.

CAUGHT IN A FLOOD

...Dug Out of the Mud, Kaylo Heat Insulation Proved Still Usable!





WATER SOAKED AND CAKED WITH MUD, these three pieces of Kaylo Heat Insulation were found partially buried in the Kansas City, Missouri, warehouse of Procter & Gamble after nearly two weeks of Missouri River flood water had receded. The unretouched photograph above shows the wet and mud covered pieces as they looked on arrival at the laboratories in Toledo, Ohio after shipment in a loosely-packed carton.

THE SAME THREE PIECES are shown in this unretouched photograph after they were cleaned by holding them under a water faucet and rubbing by hand, then dried with an electric fan. These pieces are still usable—*proof* of Kaylo Heat Insulation's resistance to water damage. Other Kaylo Heat Insulation, already installed at this plant, was under water during the flood, yet is still in place and performing efficiently.

Kaylo Heat Insulation is a hydrous calcium silicate—the heat-saving material that is revolutionizing insulation practice with its outstanding combination of advantages.

WRITE FOR FREE BOOK—"Kaylo Heat Insulation." Address: Dept. N-284, Owens-Illinois Glass Company, Kaylo Div., Toledo 1, Ohio.

KAYLO® ... *first in calcium silicate*

...*pioneered by* OWENS-ILLINOIS Glass Company

MAIN OFFICE: TOLEDO 1, OHIO — KAYLO SALES OFFICES: ATLANTA • BOSTON • CHICAGO • CINCINNATI • CLEVELAND • DETROIT
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WANTED

The most efficient equipment to make 66,000 gph of Lake Michigan water suitable for high quality feedwater to boilers operating at 900 psi at the Whiting, Indiana plant of the Carbide and Carbon Chemicals Company, a division of Union Carbide and Carbon Corp.

THE ANSWER...

A Graver Hot Process Softener System

The Graver System was selected by the Company's consulting engineer for these outstanding advantages... the *modern economical design* of Graver equipment... its *low operating cost* ... its *proven performance* for more than 40 years... and *single responsibility* because of Graver's ability to furnish *all* required equipment, fabricated in its own plants.

THE RESULTS OBTAINED:

TOTAL HARDNESS: ...reduced to less than 1 ppm

SILICA: ...reduced to less than 1 ppm

If you have a water problem, write to Graver for authoritative recommendations.

GRAVER

EQUIPMENT IN THIS PLANT

- 2—33,000 gph Type S Hot Process Softeners with internal vent condensers and chemical feeders.
- 1—66,000 gph second-stage phosphate softener.
- 2—500,000 lb per hr stainless steel-clad Tray-Type Deaerating Heaters.
- 4—8 ft x 4 ft Anthracite Filters.
- 2—wash water tanks for filter backwashing.
- Acid Feeding system to reduce pH.
- All accessories.

GRAVER

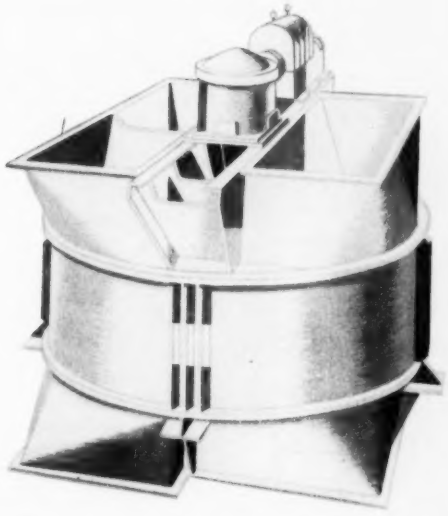
GRAVER WATER CONDITIONING CO.

Division of Graver Tank & Mfg. Co., Inc.

DEPT. PE-HP, 216 WEST 14th STREET, NEW YORK 11, N. Y.

this preheater is cutting fuel costs in hundreds of plants!

The Ljungstrom operates on the continuous regenerative counterflow principle. The heat transfer surfaces in the rotor act as heat accumulators. As the rotor revolves the heat is transferred from the waste gases to the incoming cold air.



The Ljungstrom air preheater has proved its value in industrial and utility plants throughout the country. That is why every year a constantly increasing percentage of the installed boiler capacity is equipped with Ljungstrom air preheaters.

Your fuel costs will be lower too, when your boiler is equipped with the Ljungstrom air preheater. The regenerative design of the Ljungstrom permits reliable operation at low exit gas temperatures. This assures the greatest possible heat recovery . . . reduces the amount of fuel required.

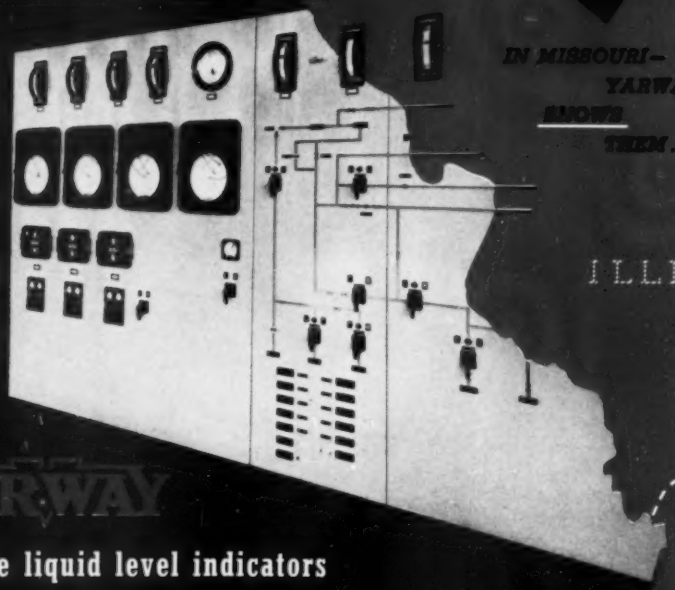
If you are planning a new installation, or expanding your present one, our engineers will welcome the opportunity to show you how the Ljungstrom air preheater can raise the overall efficiency of *your* plant.

THE AIR PREHEATER CORPORATION

60 East 42nd Street, New York 17, N. Y.

The Empire District Electric Company orders and reorders...

IN MISSOURI— YARWAY SHOWS THEM...



Seven Yarway Remote Liquid Level Indicators on instrument panel at Riverton plant of The Empire District Electric Company. Each is equipped with control unit and remote Hi-Lo Alarms.

YARWAY

remote liquid level indicators

In Missouri
(as the saying goes)
you've got to show them your product is good.

Apparently The Empire District Electric Company at Joplin was shown. Not only are they satisfied with 8 Yarway Remote Liquid Level Indicators at the Riverton plant, they also plan to use 8 others in a new installation.

Yarway Remote Liquid Level Indicators bring readings down to convenient eye level. Accuracy is assured because the indicator is operated by the liquid itself . . . by the pressure differential between a constant head and the varying head in the drum or tank. Indicating mechanism is never under pressure. There are no stuffing boxes.

New control unit permits operation of additional Hi-Lo Alarms (light or horn) at any remote locations.

See Yarway Indicator Bulletin No. WG-1823 or Bulletin No. WG-1830 for the Yarway Indicator-Recorder.

YARWAY SERVICE GOES ALL THE WAY...

YARNALL-WARING COMPANY
114 Mermaid Ave., Philadelphia 18, Pa.
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LETTERS TO THE EDITORS

TRAINING

ONE OF the most satisfactory methods of increasing power plant efficiency is the training of personnel. The training school is now a common thing, a recognized branch of many organizations. As in every endeavour, there is a deterrent influence, and we still find some who ridicule the training school, and use any means to belittle the program. An effective means to combat this situation is to choose as instructors those men who are actually engaged in engineering work. Thus the criticism of "book learning" can be in part answered.

All elements of any organization should be consulted, too, about the training methods and the context of the course. Of great importance is the manual itself. A training manual should be checked and double-checked lest errors in engineering and scientific matters creep in. Nothing will kill the interest and confidence of the students quicker. Where courses require several instructors, these individuals should have a briefing course, to co-ordinate their efforts, reveal errors in context and methods, and otherwise build a course on solid foundations.

The training course should stress fundamentals, should at all costs avoid skipping lightly over any subject. If the intellectual and experience range of the pupils vary greatly, the class should be split, so as not to rush the uninformed and not to retard the better-informed.

Instructors should be chosen with care. Sarcastic or snobbish individuals should be avoided like a pestilence. An instructor should be capable of leading — and of learning.

When a training course is being organized, it is of great importance that the branch of the main organization dealing with personnel matters be consulted, and an agreement made on the matter of credit and consideration toward those students who attend the course.

Education is a slow process. Be patient. Most mature individuals do not find study and extra effort easy.

Pawling, N. Y. WILLIAM SHEFFER

PEAT AND GAS TURBINE

I HAVE READ with much interest the gas turbine articles on page 58 of the March 1951 issue of POWER ENGINEERING, the one on page 60 of the July issue, and on page 56 of the May 1952 issue.

The heat balance diagram, Fig. 2, page 59, March 1951 issue, shows 25,291,000 Btu per hr at a temperature of 475 F in the exhaust gases, when the unit is developing 5000 kw. This waste heat, as I see it, possibly might be turned into good account in regions where the better grades of peat bogs exist and where conventional fuels are expensive.

If the pulverized-coal-fired gas turbine should prove practicable, then it might become possible to use pulverized peat. Or it might be gasified in a Mond gas producer and the turbine then operated with producer gas. Recovery of ammonium sulphate as a by-product might lower costs.

Bulletin XLV, Economic Series of the Wisconsin Geological and Natural History Survey, on The Peat Resources of Wisconsin includes five peat analyses from the Glen Beulah Marsh, 15 square miles in area and with a peat deposit 9 feet deep.

These five analyses show averages of:

	Per cent
Moisture	89.62
ANALYSIS ON DRY BASIS	
Volatile matter	65.90
Fixed carbon	25.68
Ash	8.42
	100.00
Btu per pound	9262

The 5000 kw unit described above has an input of 64,840,000 Btu per hr at full load and exhausts 25,291,000 Btu per hr at 475 F.

If the exhaust gases were passed through a long inclined rotary dryer similar to a rotary cement kiln and the temperature dropped to say, 100 F at the outlet of the dryer, approximately 79 per cent of the heat or substantially 20,000,000 Btu per hr would be removed. Assuming 80 per cent efficiency, the water evaporation would be 16,400 lb per hr.

It does not appear practicable to reduce the moisture content of peat much below 70 per cent by mechanical means.

A water content of 70 per cent means 2.33 lb of water per pound of dry peat. The 16,400 lb of water evaporated per hr by the exhaust gases would produce approximately 7000 lb or 3½ tons of dry peat.

With a heat value of 9262 Btu per lb there would become available 64,834,000 Btu per hr or substantially the same amount as the 64,800,000 Btu input in Fig. 2.

The waste heat from the turbine would dry the peat fuel necessary at full load.

Percentage of fuel that could be dried might be so high that only a relatively small amount of auxiliary fuel, such as oil, would be necessary; and this might be required only during periods of heaviest loading.

Obviously the costs of reclamation of the peat and drying plant fixed and operating expenses and other factors would have to be carefully worked out before a project of the kind, as visualized above, could be adopted as practical and economical.

CORNELIUS J. WEBER

Milwaukee, Wisc.

HUNCH

THE ARTICLE in the April issue entitled What Ailed the Centrifugal Pump brings to my mind another unusual experience with a pump.

About 15 years ago I was chief engineer of a fairly good-sized laundry. We had been burning oil about a year and it was time to do some brickwork on the furnace. This seemed like a good time to do some work on the burner also. It was a type of burner with the pump, motor, fan and other parts built as one unit. I took the burner off the boiler and took it all apart. After cleaning and checking all the parts, I took the pump apart, cleaned and inspected it, and reassembled the whole unit.

The brickwork was finished about 11 o'clock Saturday night. Sunday morning we built a light wood fire and kept it in all day. About 6 o'clock we decided to put on a light oil fire. I started the burner and it ran for 15 min and then sheared a pin.

I renewed the pin and started up again and it sheared. I took the pump apart again but could find nothing wrong and the pump turned free by hand. I put it back and started up and sheared another pin. This process was repeated several times.

As we sat around thinking, I took the pump apart once more and put in a heavier gasket between the pump and the end casing. We started it up but it would not build up any oil pressure and this was the thinnest gasket we could get. Finally, I got one of those "try anything once" hunches.

I went into the laundry and got a piece of brown wrapping paper and made up some gaskets from it. I put in two and started the burner. The M.E. shook his head. The paper will blow out, he told me. The burner ran for 20 min and we had oil pressure but again sheared a pin. I put in one more and ran for ½ hour. I put in one more and the burner ran without further trouble.

I left the company about 5 years later and those four paper gaskets were still in that burner pump, it was running normally and I guess they are still there.

The moral of the story is: when stuck, never turn down a hunch, no matter how ridiculous it may seem.

Overlea, Md. CHARLES W. PARKS

Steam for *National Premium*

This description of the steam plant for the National Brewing Co. at Baltimore, Md., should be of interest because it shows how an old plant can be turned into a modern, efficient plant with a minimum of alteration to building structure, and therefore with minimum expense. The complete automatic combustion control system installed here and the details of other equipment are also described.

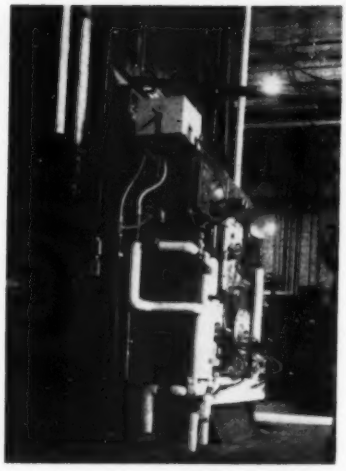


Fig. 1. A view of the new boiler showing the three oil burners and the steam pressure regulator for controlling the flow of oil to the three oil burners

CONNOISSEURS of good beer, for many years, have held National Premium in high esteem among the best beers brewed, and for good reason: the National Brewing Co. in all of its 67 years of operation has never compromised with quality. Started in Baltimore in 1885, this brewery prospered and grew through the years and except for the period during prohibition, when brewing operations ceased, it has maintained a consistently high quality product. National Premium beer is known throughout the nation.

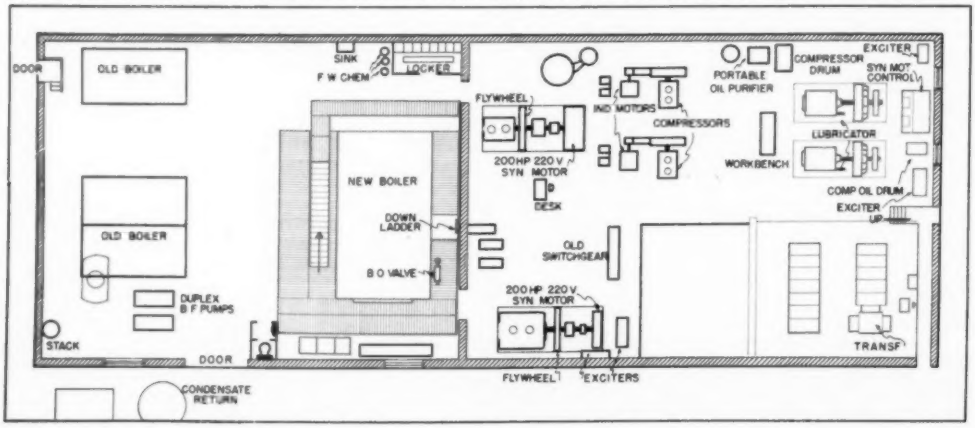
A brewery, like other food producing plants, is a large user of steam, as well as of water and refrigeration, and our interest in the National Brewery in this article lies, not in the brewing processes, but in the power plant which supplies it with steam and water. This power plant is essentially a steam plant since all electricity used is purchased from the local utility company.

After the repeal of prohibition, the brewery resumed operation in January 1934. At that time three Keeler oil-fired (Williamsport, Pa.) boilers were installed. These boilers were in continuous operation until recently when they were replaced by a new Riley steam generator. The Keeler units are still available for standby or emergency use, but the new steam generator now carries the entire load. Operating under automatic combustion control and with forced draft, the new boiler is capable not only of carrying the entire load but its flexibility in meeting rapid load changes has improved the over-all performance of the plant.

This new boiler is installed in the old boiler plant as shown in Fig. 2. Its height was somewhat too great to permit placing it under the existing roof so the building structure was modified, as shown in the sketch, Fig. 3. One-half of the sloping roof was removed. Next, the right wall was extended upward to a point level with the gable and a new concrete slab roof built to connect with the gable as shown. This now provides ample headroom above the new boiler.

Like its predecessors, the new boiler is oil fired. It is a Riley Stoker

Fig. 2. Plan of the power plant with the boiler room at the left and with new equipment in blue. This shows how all the changes were made at minimum cost



Corp., Class RX3 boiler built for 161 psi working pressure and is rated at 45,000 lb of steam per hour. Normal steam pressure is 125 psi. The unit has a total heating surface of 5020 sq ft — 4120 sq ft in the boiler proper and 900 sq ft in the water walls. Three Peabody Engineering Co. oil burners are installed in the front furnace wall. The arrangement is such, however, that in case of an oil shortage, a stoker can be installed so as to permit the use of coal.

Forced draft is supplied by a Clarage fan installed below the operating floor and under control of the combustion control system. The latter is a Brooke Engineering Co. system in which the fuel-air ratio is controlled with a metered correction from flue-gas density. It uses electric and electronic circuits in its relay system and electrically operated power units. The master, or steam-pressure regulator, combines both primary element and power unit controlling the fuel feed. No attempt will be made here to describe this combustion con-

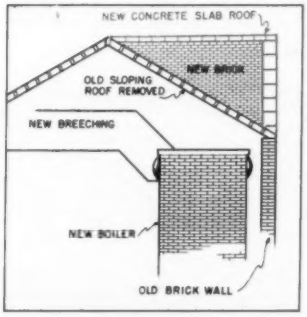


Fig. 3. Sketch showing constructional changes necessary to fit new boiler in existing boiler house

trol system in detail but a general idea of its operation may be had from the schematic drawing shown in Fig. 4.

The forced draft regulator, Fig. 5, has a slide-wire potentiometer. Both units, together with a fuel-air-ratio-adjustment potentiometer on the control panel and an electronic proportioner, form a sensitive bridge circuit. Movements of the steam pressure regulator potentiometer upset the bridge circuit, causing the forced-draft regulator to make compensating movements to keep the circuit balanced. This automatically makes the forced draft regulator follow changes of the master regulator in direct proportion. The ratio of movement of the two regulators can be varied by the fuel-air-ratio-adjustment potentiometer.

The fuel-air-ratio potentiometer may be set by hand or automatically through the flue-gas-density measuring units and circuit. The motor for automatic operation responds to impulses from the photoelectric cell through the electronic controller. The

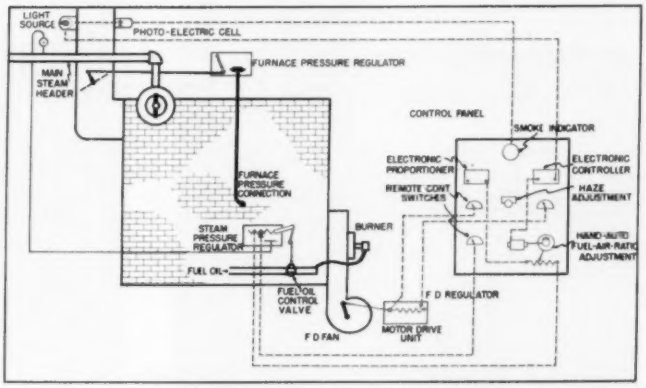


Fig. 4. Schematic drawing of the combustion control system showing location of electronic control devices

amplified photoelectric-cell current responds to minute changes in flue gas density and functions to correct the air flow so as to restore the density to that of best fuel-air ratio. The forced-draft regulator responds always to the upset in the bridge circuit, whether it is caused by the master, manual control, or flue-gas density change. It functions to bring the electronic circuit back into balance and thus reestablish proper air flow through the boiler.

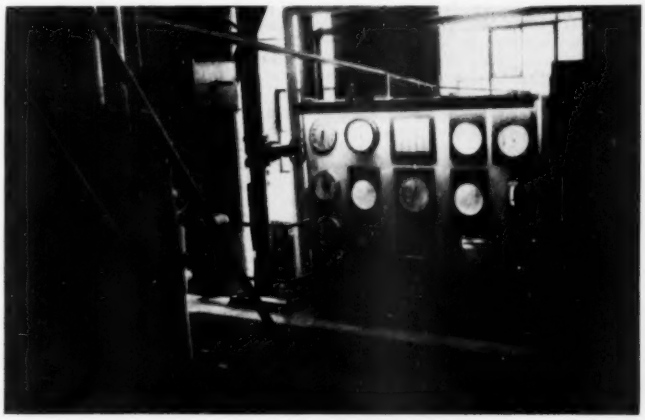
The entire control panel shown in Fig. 5 is mounted on the main boiler control board on which are mounted all necessary meters, recorders and operating control for the entire boiler. This board contains the following equipment:

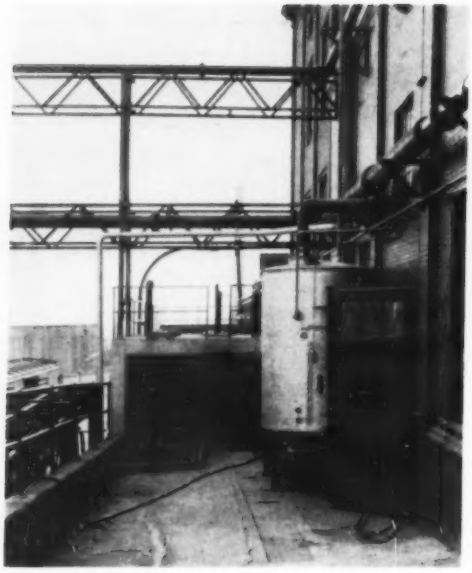
- Ashcroft steam pressure gage
- Minneapolis-Honeywell steam pressure gage
- Ellison 5-element indicating draft gage
- Brown *Electronik* smoke recorder
- Ranarex (Permutit Co.) CO_2 indicator and recorder
- Minneapolis-Honeywell steam flow recorder
- Hays-Penn boiler water level recorder
- Yarway water level indicator
- Brown *Electronik* strip chart, stack gas temperature recorder
- *Liquidometers* for indicating amount of fuel oil in storage tanks
- Push button controls for oil pump motors

The boiler is equipped with Diamond Power Specialty hand-operated soot blowers, Copes feedwater regulators, Yarnall-Waring water columns, Consolidated safety valves, Schutte and Koerting main stop and check valves, Yarway balanced seat blow-off valves and a Penberthy injector for emergency feed-water supply.

Fuel oil is stored in two 15,000-gal tanks housed in a separate building outside the boiler house proper. This installation also includes a Schutte and Koerting Co. package type duplex pumping, heating and straining unit. This consists of a duplex suction and a duplex pressure strainer, two fuel

Fig. 5. View of the boiler control board on the operating floor in front of the new boiler. The combustion control panel can be seen at the lower left of the board. This panel carries all needed electronic devices





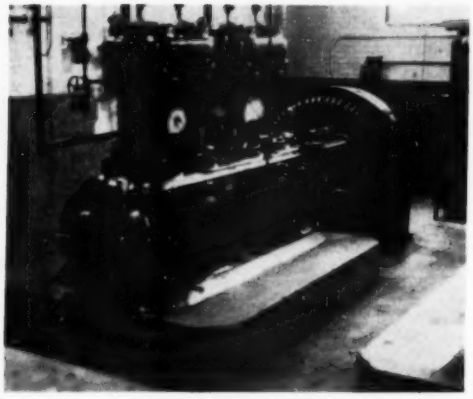


Fig. 6. (Above) One of two new York Model D-8, 4-cylinder direct-connected ammonia compressors driven by 250 hp. 360 rpm scynchronous motors

Fig. 7. (Left) A view outside the boiler house showing the blowdown tank and the fuel oil storage and pump house supplying fuel to the plant

oil heaters, two gear pumps and accessory equipment. This equipment is mounted on a single base plate and forms an extremely compact and flexible arrangement. It handles around 19 gpm of Bunker C fuel oil at 125 psi. The oil suction temperature is about 90 F, the oil heater outlet temperature about 200 F.

Steam atomization is used in the burners. A steam pressure regulator on the fuel oil line maintains a steam pressure 20 psi higher than the oil pressure at all times. The oil temperature at the burners is around 175 F and the oil pressure 42 psi. Fuel oil is metered by means of a Niagara (Buffalo Meter Co.) integrating meter and the flow regulating valve is an Atlas valve. Ordinarily, it is possible to operate the boiler at full load with only two burners.

City water is used as boiler water. About half of the water used is make up, the other half is condensate returned to the boiler house from the brewery. Condensate plus make up collects in a condensate return tank located just outside the boiler room. A condensate pump then pumps the water up to the new Cochrane deaerating heater installed in the upper part of the boiler house. This heater is supplied with exhaust steam from the boiler feed pumps which are the old duplex steam units used with the old Keeler boilers. The feed pump suction is directly from the deaerating heater. The city water used is of good quality and only a minimum amount of chemical treatment is necessary.

As shown in Fig. 2 the refrigerating compressors and the electrical substation and switching equipment are located in a large room adjacent to the boiler room and on the same level. All the old electric switching equipment has been replaced by a new General Electric load center substation. This equipment, consisting of a Pyranol insulated transformer and associated circuit breakers, buses, metering equipment, etc., is mounted on a raised concrete platform enclosed by a steel wire fence. The substation is rated at 1500 kva and it reduces the primary voltage from 13,500 to 480 v.

There are six ammonia compressors, two of which are old belt driven, slow speed machines, while the others are direct connected to synchronous motors. Two of the four are new York Corp. Model D-8, 4-cylinder machines driven by 250 hp, 360 rpm synchronous motors. Separate, motor driven exciters are installed.

The operation of this power plant is under the general supervision of Edward Schneider, Chief Engineer, with Garland Humphrey as Assistant Chief Engineer. Both Mr. Schneider and Mr. Humphrey are ex-marine engineers and many of the details of plant design reflect the characteristic resourcefulness of the marine engineer. As an example, all the stairways, walkways and platforms around the new boiler, and in the boiler room generally, were built by the maintenance crew from odd pieces of steel scrap found around the plant.

This power plant is adequate to meet all present needs of the National Brewery but if additional steam capacity is needed in the future, a second new boiler can be installed in place of the three old Keeler boilers.

Today, National's imposing plant in Baltimore includes a new 10-story brewhouse and stockhouse with the latest type of brewing equipment. Brewing operations start at the top of this building where a 500 bushel whole malt hopper is located. From this point on, practically all of the movement of the brew is by virtue of gravity flow. Two show pieces are the new shining copper brew kettles, never-ending source of attraction.

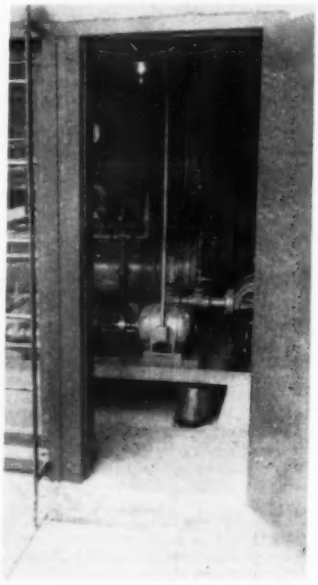


Fig. 8. Installation of Schutte and Koerting Co. package type duplex pumping, heating and straining unit for handling the Bunker C fuel oil

Your Electrical Distribution System—

How to Survey It

By PAUL C. ZIEMKE
Oak Ridge, Tennessee

A complete engineering survey of your plant's entire electrical distribution system will disclose its hidden weaknesses before they can cause a breakdown. . . . To make such a survey, you need the proper electrical measuring instruments. . . . This article tells you what they are and just how to use them to measure loads, voltage drops and all necessary data throughout every circuit. . . . These measurements will enable you to spot under-loaded and over-loaded circuits or motors, wrong voltages, bad insulation, low pf

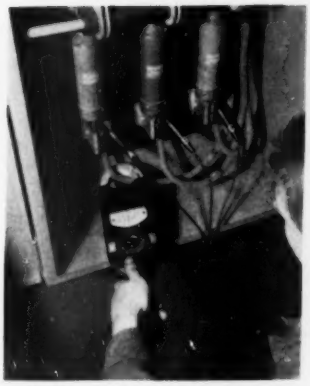


Fig. 1. Here's circuit-testing simplicity personified!

INSTRUMENTS needed for load survey work must be in excellent order, lest the results obtained lead one far afield. Number and type of instruments required depends on the circuit's characteristics. Their types and uses are indicated here and shown diagrammatically in Fig. 2:

Single-phase load or two-wire, single-phase — ammeter, wattmeter or analyzer.

Polyphase loads or four-wire two-phase — two single-phase wattmeters, or one polyphase wattmeter or analyzer.

Polyphase loads or three-wire, three-phase — two single-phase wattmeters, or one polyphase wattmeter or analyzer.

Motor-starting & running circuits on any motor — two ammeters — one for starting current, one for running current, or analyzer.

These instruments will give instantaneous readings, which for ordinary purposes will suffice. However, for a more detailed and precise check, the use of graphic meters is suggested, since these cover a known period of operations. Without a graphic record it becomes most difficult to analyze the true load of motors that may be operating at quite undesirable efficiencies. The curves developed will reveal facts regarding such conditions as: intermittent heavy-duty cycles, motor-starting characteristics, adaptability of motor speed to machine operations, "plugging" currents on reversing service, and other hidden facts of lesser degree of importance.

Such curves should also reveal the presence of gradually-increasing loads that occur as machinery wears out, works out of alinement, develops stoppage in circulating systems, or suffers from inept attention on the part of the lubrication man. Such bad actors as the loafing, over-sized motor are soon detected, as are low voltage and poor power factor.

We will use two voltmeters for this operation, with a graphic model giving us curves while the indicating unit relates instantaneous facts common to a given circuit. By use of the stop watch, we check the indicating

Fig. 2. For the various types of circuits you have to survey, here are the instruments you need. Various combinations of voltmeters, ammeters and wattmeters are used

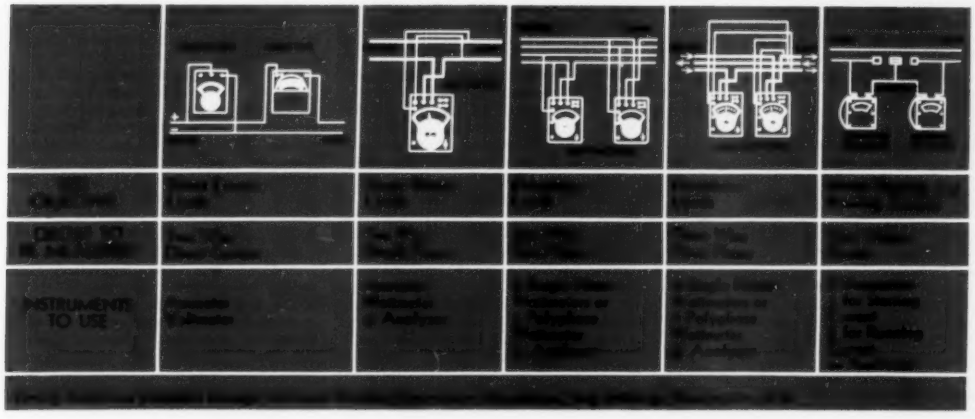


Fig. 3. Splice box is removed, three phases metered with hook-on wattmeter

Fig. 4. Electrician makes load check at contactor box, a convenient location

voltmeter against the proper point of the chart as the circuit is loaded under average conditions.

Some electrical men find it advantageous to use two curve-drawing meters, which are clipped to the circuit under test at two selected spots, to learn the voltage differential between these points. With both instruments calibrated to match, the readings are checked and, unless the timing is off, effective voltage curves are developed for that circuit. If the drop proves to be more than an acceptable value for that type of service (3% for power, and 1% for combination power and light) evidence is at hand to prove we need improvements in copper sizes and the like.

In one plant surveyed, it was found that the drop could be eliminated by changing the voltages taps on the three transformers, once the first cover had been removed to reveal the hitherto-unknown tap-changing feature. In another case, the taps were already at maximum value and the installation of capacitors, plus an exchange of a 100-hp synchronous for a wound-rotor compressor motor, restored power factor nearly to unity.

New Instruments

Of vast importance are the products of the research laboratories in recent years. One of these gives a dual-reading voltmeter (double scale) with leads of sufficient length to reach any reasonable location for attachment.

The second one is the hook-on type wattmeter developed by G-E engineers. Use of this is shown in the illustrations. Since this instrument clamps around a conductor in the wink of an eye, time is saved and service is not interrupted at all. Single-phase and polyphase circuits are measured with equal accuracy; power factor can be checked by the simple expedient of using the Model AK-2 in combination with the AK-1 hook-on ammeter. Versatility of the meter is further demonstrated by the fact that, in addition to measuring kilowatts, it will measure kilovars in balanced three-phase circuits. The large, legible figures on the dial lend themselves to quick, accurate readings, leaving one hand free to log the readings on the chart. Lower ranges may be obtained by looping the conductor through the hook and dividing the resultant reading by the number of loops used.

Instrument Characteristics

These hook-on instruments have the following characteristics:

Ratings: 0–3, –6, –20, –200, –300kw
15–600 amp
100–600 v

Accuracy: ± 5% of scale, full value

Frequency: 50 to 70 cycles

Voltage Breakdown Test: 4000 v a-c

Scale Length: 2.5 in.–90 deg

Weight: 3½ lb

Size: 14 in. long, 4 in. wide, 2½ in. deep

Clamp Size: Will encompass any conductor up to two inches

Essentially the unit consists of a ferro-dynamic wattmeter, the field of which is energized by the conductor carrying current through the hook. By use of the spring-controlled moving system, the resulting scale capacity is directly proportional to the potential circuit resistance. With this design, range selections can be made by simple one-hand switching of the potential circuit.

To measure single-phase circuits, the dial is set at the high value of 300 kw, the clips are attached to the circuit, the clamp is passed around the conductor, and the range knob is adjusted to obtain the right scale reading.

Reading the Meter

Rated line voltage and kw ranges are indicated as:

Rated Line Voltage	Kw Ranges
120 v	3, 6, 20, 60, 200, 300
120 to 240 v	6, 20, 60, 200, 300
120 to 600 v	20, 60, 200, 300

Note: In using, check kw setting on range knob and read corresponding scale.

On one survey a great portion of the load was fed from "variacs" to heating devices, requiring voltage control of infinite pattern. Test runs in progress could not be interrupted until concluded. The engineer produced the answer when he brought out a loop from the tirex cable at its junction with the splice box on the variac, as each run was concluded for the interim. At the same time, he installed a service receptacle in the splice box, across the output line. With the loop exposed, the current was easily measured progressively from heat test unit to heat test unit, all down the line. The voltage was read by inserting a plug-equipped voltmeter in the receptacle. The hook-on meter still worked.

Fig. 5. Just a few inches of slack conductor and we can quickly learn, with the hook-on meter, all the facts about the electric load on this industrial machine

The hook-on wattmeter will measure active and reactive power in balanced polyphase systems. There are several methods of obtaining polyphase readings, such as taking a simple reading and multiplying by a factor to determine polyphase, or by using the two wattmeter method.

For three-phase, three-wire power measurements, two readings are required. Connect cords to phase A and B for the first check, then change the A phase clip to C phase and add the readings. If it is necessary to reverse potential connections to obtain one reading, that reading should be subtracted from the other. The clamp for step one encircles B phase, and for step two the C phase.

Total kw in a balanced circuit may be determined by a single reading. The cord clips are connected to phase A and B of the four-wire circuit with the clamp encircling A and B, with the conductors crossing each other in the clamp.

Reactive power (vars) in balanced three-phase, three-wire circuits is measured by placing the clamp around one conductor and clipping the potential leads to the remaining two.

For single-phase circuits, measurements are made by connecting the potential leads to the power wires and clamping around one of them.

The Type AK-2 hook-on wattmeter is designed for use on circuits below 600. Voltages above that value may be measured by use of a potential transformer, provided the conductor is insulated for the line voltage with a wide margin of safety. Use of the AK-2 on bare conductors energized above 600 v is extremely hazardous and should not be attempted.

This instrument employs an advanced principle of circuit design to meet the needs for a lightweight analyzer with a few simple, convenient connections and all readings made on a single dial.

Besides serving as a standard 0–2.5/5/25/50-amp ammeter and a 0–150/300/600-v voltmeter, or with split-core and conventional instrument transformers to extend the range, the instrument can be used to determine easily and accurately watts, vars, volt-amperes, and power factor for load surveys, induction-motor tests, reactive power studies, power factor checks.

One of the most important parts of a complete electrical system survey is an analysis of power factor, to see how much it can be improved and how it can be done.

Industrial and Utility Interconnections

By V. F. ESTCOURT
Pacific Gas & Electric Co.

OPERATING and economic problems related to interconnection of industrial and public utility systems depend upon the type of industry, according to the author in a paper presented to the American Power Conference in March.

Basic advantages of interconnection to an industrial are the public utility's ability to provide firm outlet for by-product fuels; and, because of their large capacities, to remove economic hazards in balancing power and process requirements.

Pacific Gas & Electric first interconnected in 1927 with a lumber mill; next with 3 oil refineries — the Avon plant of Tide Water Associated Oil Co., and Shell and Union Oil's Martinez and Oleum plants respectively.

Now the utility supplies 15,000 lb of steam and 2000 kw to the lumber mill. Payment is made with excess hog fuel, a certain amount of which the utility agrees to purchase with option on additional purchase.

Each oil refinery load is served by two 12-kv feeders, one from each generator bus section, through step-down transformers. Avon and Martinez plants each have one 50,000-kw, 3600-rpm, hydrogen-cooled tandem-compound turbine generator with automatic extraction at the exhaust of the high-pressure turbine. Oleum has two units of the same design and capacity.

Because PG & E's system is 50 per cent hydro, during Spring run-off steam plant operation is reduced to take advantage of the excess water. With the automatic extraction units, by-passing a portion of refinery steam requirements around the turbine through reducing valves, it is possible to carry a minimum load of 5000 kw. During system conditions the stations perform normally.

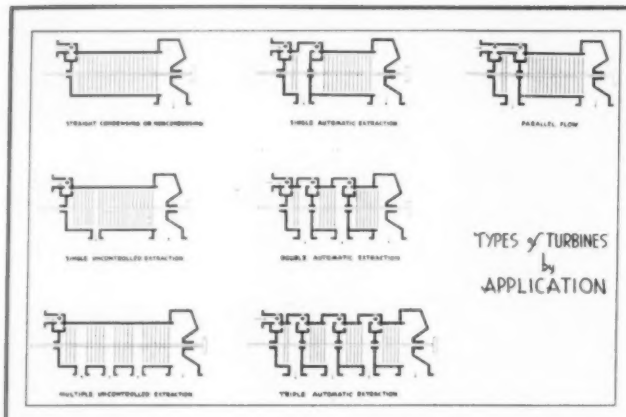


Fig. 1. Types of process steam turbines by applications. Elementary process turbine exhausts either at pressure close to process pressure, or to condenser. In the extraction turbines, the extraction may be controlled to maintain process pressures or in some cases may be uncontrolled. In the parallel flow turbine, the independent process turbine and the power balancing turbine are combined into a single unit. Automatic extraction turbines may be of single, double or even triple extraction types, with multiple sectionalized nozzle control valves to give improved efficiency and increased outputs at steam flows below designed power. Smooth transition of control is important in limiting trip-outs during plant disturbances. These turbine combinations fit many industrial conditions

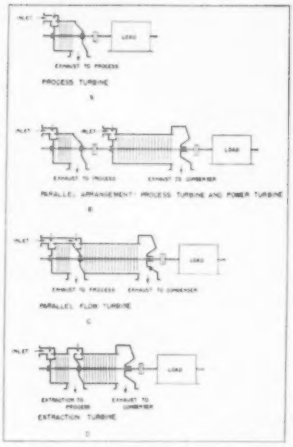


Fig. 2. Relations of various combinations. A—Process turbine. B—Parallel arrangement; process turbine and power turbine. C—Parallel flow turbine. D—Typical extraction turbine

Process Steam Turbines for Industry

By **A. D. SOMES,** Steam Turbine Engineering Division, General Electric Co.

MANY INDUSTRIES use large quantities of heat, as well as large amounts of power, for processing their product.

By generating steam at a pressure above the process level and using the expansive energy in a turbine, power can be produced at a very low incremental fuel rate. The large economic gains obtainable from combining the need for power and process steam have led to the development of a wide variety of steam turbines to supply both uses. These are commonly referred to as "process steam turbines," and power produced from the process steam is known as "by-product power."

Power at 4250 Btu per Kwh

Where steam must be generated to serve the needs of the process, by-product power can be made by a process turbine at an additional fuel consumption of approximately 4250 Btu per kwh as compared with 11,500 Btu per kwh for prime power in an equivalent plant. Where a reasonable balance exists between the plant power requirements and the power available from the process steam, the plant power requirement can be obtained at a very low cost compared with firm power.

The plant investment is, of course, increased by the use of the higher pressure and temperature equipment, but the increased cost per kw of capacity is generally only a fraction of the cost of prime generating equipment. These factors were reviewed by the author in a paper at the Fall 1951 meeting of the ASME in Minneapolis, to be published in full by the ASME. He then discussed the following points.

The Turbine and the Process

In application, the process turbine becomes an integral part of the processing plant. In fact, there is a trend today to lay out plants with large process steam needs in straight line units; boilers; turbines for process steam by-product power and firm power; and product processing equipment. Reserve equipment is not provided, for the reliability of modern boilers and turbines is high, and outages from other causes are frequent enough to provide for necessary maintenance.

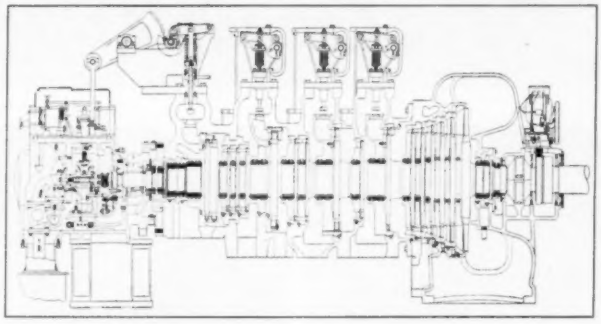
Basically, the turbine accommodates itself to the steam flows required by the process while extracting as much power as practical. The flow through the turbine must exactly balance the process requirements. This could be accomplished by a regulating valve in the steam line ahead of the turbine controlled by the pressure in the process line at the turbine exhaust. In effect, it would operate as a pressure controlled reducing valve, with the major portion of the pressure drop utilized in the turbine to produce power. The combination is the simple, single throttling valve control frequently used on small turbines.

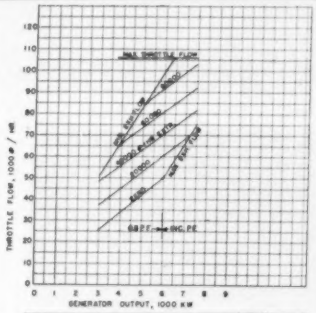
Multiple sectionalized nozzle control valves give improved efficiency and increased output from the turbine at flows below the designed power as compared with the single throttling control valve.

Steam and Power Proportions

In the simple process turbine, at times, the power output from the process steam may exceed the plant power requirements. The excess power must be utilized elsewhere or the steam flow through the turbine limited to the power demand, with the additional steam for the process made up by a separate reducing valve from the boiler. The turbine valves then operate to balance the power demands instead of the process steam demands.

Generally, the power requirements





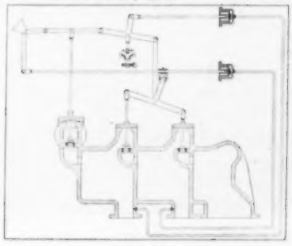


Fig. 3.—Above. Triple-automatic-extraction admission turbine for industrial power plant. This is a 10,000 kw machine, taking throttle steam at 1200 psig, 950 F, and exhausting to a condenser at 2 in. Hg abs. Steam is also admitted at 400 psig and is extracted at 150 psig and 80 psig

Fig. 4.—Upper Right. Performance curves for a single-automatic industrial extraction turbine: 6000 kw, 0.8 pf, 3-phase, 60-cycle, 13,800-v generator; steam conditions, 1250 psig, 950 F, 2 in. Hg abs back pressure; automatic extraction at 70 psig. Other types are shown in paper

Fig. 5.—Lower Right. Schematic diagram of double 3-arm valve mechanism for automatic extraction turbine. Such mechanisms must operate in conjunction with the speed governor and the extraction pressure governor to change the steam flow through the various sections of the stream turbine

exceed the output available from the process steam with normal operating conditions, and the additional power must be made up from other equipment. Most large industrial plants producing large amounts of by-product power also make their own firm power. The close relation of the power equipment and product equipment makes direct control essential.

The topping turbine, exhausting to the steam supply for existing power generating equipment, is a special form of process turbine where the immediate product is power. In the more complex forms of process turbines, such as the automatic extraction turbine, the topping duty may become inseparably mixed with the normal process operation.

Various Steam Conditions

In some plants, it happens that steam is made available beyond any process needs at the pressure level from some part of the process, such as waste heat boilers or exhaust from other process turbines. This steam may be used in a process turbine exhausting to a lower process pressure or to a condenser. Alternatively, the steam may be inducted into another turbine in the reverse operation of extraction. In fact, most automatic extraction turbines can be modified to take in a limited amount of steam in this way by rather simple changes.

While an independent process turbine and power balancing turbine are often used, the two can be effectively combined into a single unit to form an automatic extraction turbine or a parallel flow turbine. In industrial plants, the automatic extraction turbine is the most frequently-used type.

The advantages of combining the several elements into a single unit are: (a) lower cost, (b) less space, (c) reduced losses, (d) higher average output with widely varying flows, (e) co-ordinated and simplified control, and (f) less hazard of outages.

Combination Units

The relation of the basic process turbine, operating with a power balancing turbine, to the parallel flow or extraction type turbine, is shown in Fig. 1. It is less costly to combine the two turbines into a single casing with the flow divided to pass through each machine in parallel as shown in Fig. 2.

Both the process turbine and the power turbine must be made large enough to take the maximum range of process steam flow and power. When the process turbine is operating with full flow and output, the load balancing turbine has a reduced load on it. When the process turbine is operating with a low flow and output, the power balancing machine has high output. It will be seen that the load conditions on the two machines change in opposite directions so that at least one machine is always operating at an unfavorable efficiency condition due to part load on it.

Combining the process turbine with corresponding upper stages of the power producing turbine, as shown in Fig. 2, permits that group of stages to operate with less widely varying flows and at a higher average flow. The combined arrangement is referred to as an "automatic extraction turbine," and is characterized by having a set of control valves, known as extraction valves, in the mid-portion of the turbine controlling the flow through the lower stages. These valves co-operate with the control valves at the main inlet to simultaneously supply the process steam demands at the required process pressure and to allow sufficient flow to pass through the lower stages of the turbine to meet the load requirements.

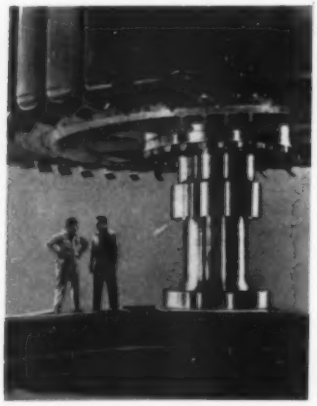
Double and triple automatic extraction turbines are further developments of the principle applied to the single automatic extraction turbine, where process steam is used at two or three pressure levels. A single turbine may be used to supply steam at all levels, or various combinations of turbines may be used in parallel to supply the different levels.

Typical Installation Study

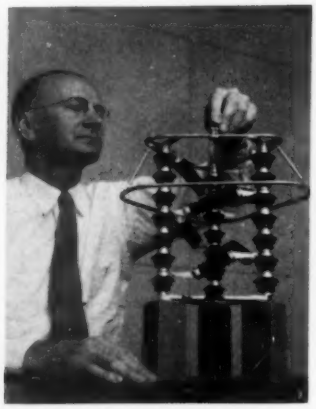
A tabulation and diagram in the paper show various combinations of extraction turbines for a typical industrial case requiring process steam at three levels — 425 psig, 160 psig, 70 psig. Steam for the unit would be generated at 1250 psig and 950 F.

Methods for estimating turbine performance are given in: Modern Turbines by L. E. Newman, John Wiley & Sons, Inc. (first published as articles in *Power Plant Engineering*, 1938, 1939 and 1945) also in How to Estimate Turbine Performance with Uncontrolled Extraction, by E. V. Pollard, *Power Plant Engineering*, April 1947.

Power Engineering

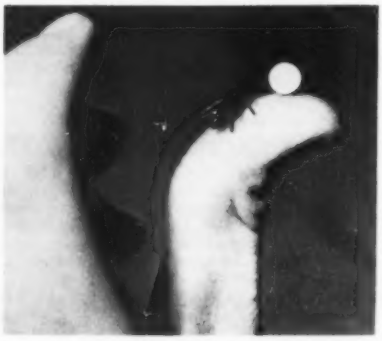


A 230-ton hydraulic generator rotor built and recently installed by General Electric in Finland. (No, the engineers are not fighting—just talking Finnish)



A. M. Opsahl of Westinghouse Electric Corp. with model of high-voltage lightning arrester he designed. It is 10 ft high when used on 230-kv lines

U. S. Rubber Co. expansion joint 8 ft high, 21 ft wide, and 1 ft face to face, of rubber and fabric, installed on condenser at Green's Bayou station

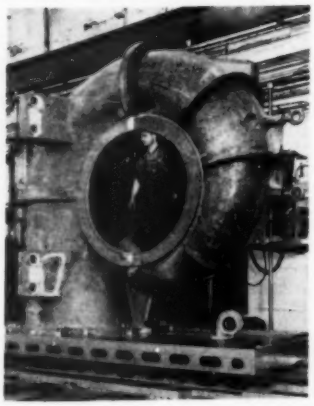


Million-volt corona motor developed by the Westinghouse Electric Corp. helps develop high-voltage equipment like the "Watch-case" circuit breaker

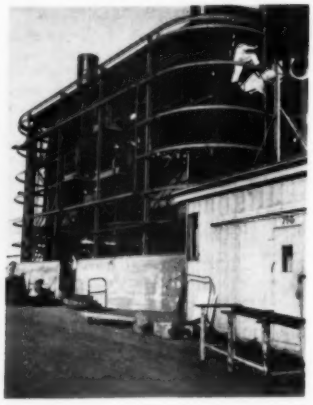
Left—House-fly-size selenium rectifier disk made by the General Electric Co., used in industrial equipment and intricate computing machines for defense work. They are placed in compact stacks and enclosed in glass, metal, or plastic tubes

Right—Largest generator stator ever built by the General Electric Co. It is for a 110,000-kw tandem-compound, triple-flow turbine capable of generating 121,000 kw. Note the extra trucks on the flat car to handle the 200-ton load

A giant and a pygmy pump at the Fairbanks-Morse plant. Pumps are the same model. Large one has a capacity of 80,000 gpm and smaller 800 gpm



Lockheed Aircraft Corp. workmen erecting a steel and concrete wall around their new high-pressure steam boilers to protect them from A-bomb damage

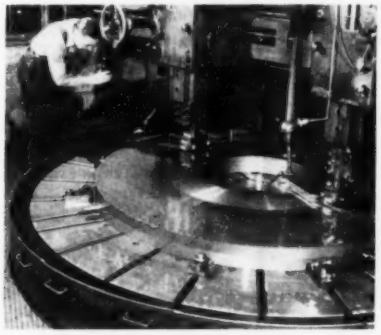


NEWS REEL

One of three 37-ton segments that make up the stator of a 33,555-kva Westinghouse hydroelectric generator built for U. S. Engrs., Buggs Island, Va.

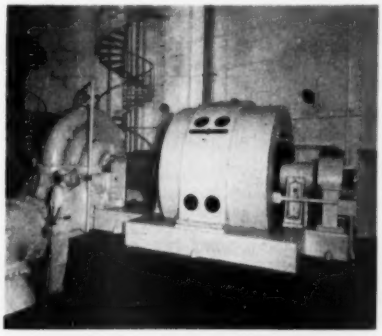
100-kw generator built by North of Scotland Hydro-Electric Board, experimenting with power generation by wind power at the Orkney Islands

Steel mandrel, on which transformer insulating cylinders are wound, being pushed out by stripper at General Electric's transformer plant



Left—Rotating half of General Electric hydroelectric generator thrust bearing being polished. Mirror surface is necessary for thin oil film which separates two halves and supports load of almost 1000 tons (wt of rotating parts and thrust)

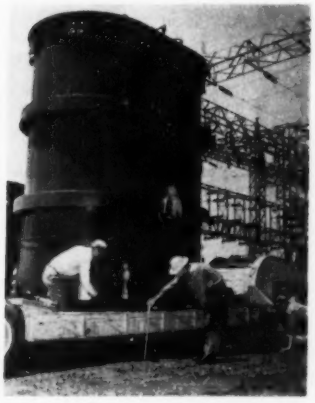
Right—De Laval pump with a capacity of 60 mgd driven by a General Electric 2500-hp synchronous motor, installed at the Louisville Water Co., Louisville, Ky. This installation pumps 1500 gal per kwh compared to 1380 gal for the old pump

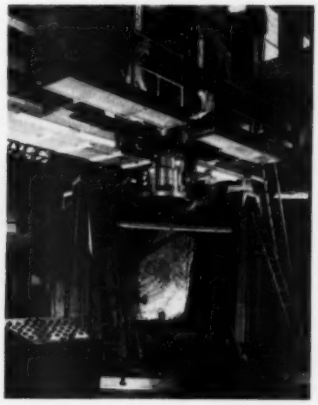


Metropolitan Edison Co's Smith St substation capacity in York, Pa. will increase from 80,000 to 130,000 kva when this last G.E. transformer is in

Caterpillar diesel tractors pushing coal with bulldozer blades on a 400,000-ton pile. Crushed coal is dumped from conveyor (top) for piling

Adjustable-pitch Kaplan type runner vane, one of two for 55,000-hp hydraulic turbines at Allis-Chalmers, being machined on 30-ft boring mill





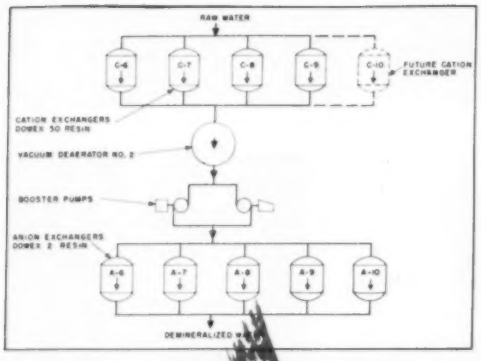


Fig. 1—Above. Flow diagram, Section [illegible]'s demineralizing water treatment plant which supplies boiler feedwater to units like that shown in Fig. 2

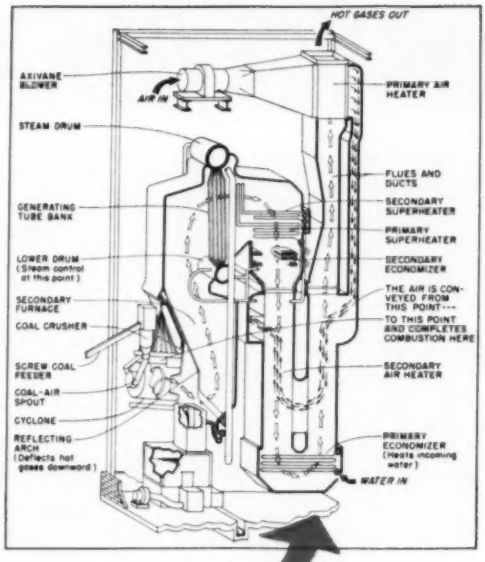


Fig. 2—Right. Perspective diagram showing gene[illegible]truction and water and gas circuits of one of the cyclone-fired steam g[illegible] units, 400,000 lb per hr, 1250 psi, 950 F, one of two installed in South [illegible]ation of Dow Chemical Co. and served with 100 per cent make-up by de[illegible]ing system

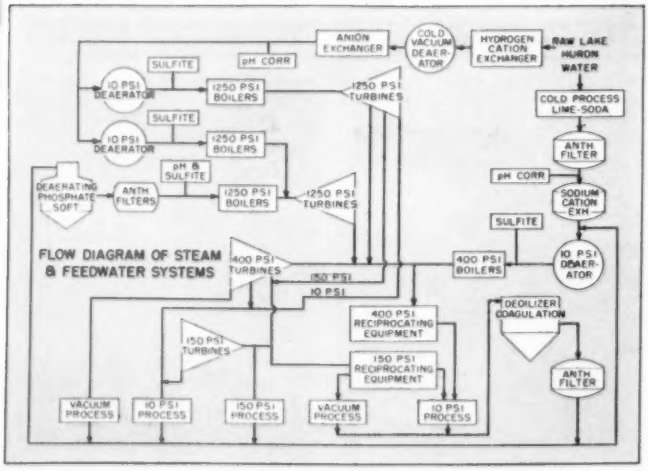
Dow's Demineralizing Experience

By M. E. BRINES, Assistant Superintendent of Power, The Dow Chemical Co., Midland, Mich.

TO PROVIDE a satisfactory supply of boiler feedwater for its 1250-psi steam generating units, The Dow Chemical Co. at Midland, Michigan, has built a demineralizing plant having many unusual features, which have been described in the literature.

First two of a total of five 1250-psi boilers were supplied with feedwater by a deaerating hot-process primary phosphate softener treating contaminated condensate returns. This will later be converted to ion exchange operation.

Fig. 3.—General schematic flow diagram of the steam and feedwater systems of The Dow Chemical Co.



The third 1250-psi unit was a cyclone-fired boiler, as described in *Power Generation*, now POWER ENGINEERING, in March 1949. Two more cyclone-fired units were installed in 1950, as described in POWER ENGINEERING, September 1950. A study for the last two units showed that they would have to operate on 100 per cent make-up water. To prepare it, the study showed that demineralization, using Lake Huron water as raw water supply, would do it.

First section of the demineralization plant was described in the literature; the second section went into operation in 1950. The author, in a paper before the American Power Conference in March 1952, reviewed the operation of section 1 of the de-

(Continued on page 114)

Table showing water analysis. All data are given here as ppm except pH and micromhos conductivity

RAW WATER		BOILER WATER	
pH	8.0	pH	10.5–10.7
CALCIUM AS Ca	50	Na_2O	25
MAGNESIUM AS Mg	6	Na_2SO_3	20
SODIUM AS Na	3	Na_2SO_4	30
CHLORIDE AS Cl	10	Na_3PO_4	60
SULPHATE AS SO_4	12	SiO_2	5
BICARBONATE AS HCO_3	105	"M"	31
HARDNESS AS $CaCO_3$	182	"N"	59
SILICA AS SiO_2	1.7	CONDUCTIVITY	500
IRON AS Fe	0.04		
DEMINERALIZED WATER		**FEED WATER**	
pH	7.0	pH	9.4
SILICA AS SiO_2	0.02(Max)	SILICA AS SiO_2	0.02(Max)
IRON AS Fe	0.02(Max)	IRON AS Fe	0.02(Max)
CO_2	0.0(Max)	CO_2	Nil.
CO_2	Nil.	DISSOLVED OXYGEN	Nil.
DISSOLVED OXYGEN	0.15	PHOSPHATE AS PO_4	0.25
CONDUCTIVITY	0.75	CONDUCTIVITY	3.00

How to Size Piping and Valves for Flashing Mixtures

By W. F. ALLEN, Jr.
Mechanical Engineer, Mechanical Division
Stone & Webster Engineering Corp.

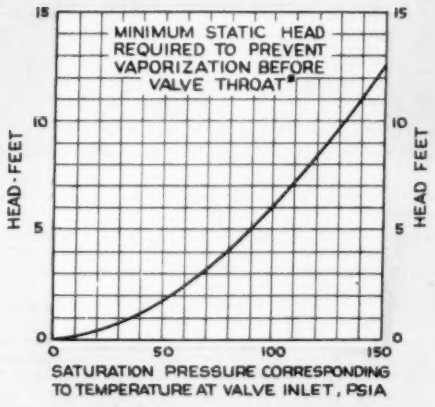


Fig. 1. Curve showing minimum static head required at control valve inlet to prevent vaporization before steam-water mixture passes valve throat

This is second of two articles (first in May issue) on sizing of pipe and valves for flashing mixtures of steam and water. . . . Here you learn how to figure them when flashing occurs under various conditions at control valve. . . . Best of all, there is a handy chart on page 84 from which you can quickly find correct size of valve without elaborate calculations

HOW FLASHING MIXTURES of water and steam must be designed for, with formulas and a typical example worked out, was covered in the first of these two articles in the May issue. There it was shown that the piping and control valves must be of the proper size, otherwise the flashing mixture might erode them, also might impede flow.

Design to minimize erosion was discussed; proper design formulas were given and worked out numerically, and their bases explained. Following this, we considered a piping and valve system, Case A, susceptible to flashing in which the flashing may be eliminated by proper methods.

In this article, as promised, we shall discuss Cases B, C and D in which flashing may occur in or at the control valve under various conditions.

Case B — System in Which Flashing Will Not Occur Until the Fluid has Passed Through the Throat of Control Valve: — Many times it is desirable, particularly for initial pressures less than 35 or 40 psia, to design the piping so that flashing does not occur before the throat of the control valve, for this will result in a minimum valve size. This is not always feasible if the control valve is located adjacent to the receiver at the end of a long run of pipe. Figure 1 shows the minimum static head required at the control valve inlet to prevent vaporization taking place prior to passage of fluid through the throat of the control valve.

This static head can be obtained by placing the valve below the source of fluid or by subcooling an amount equal to the static head of liquid required. If the total difference in elevation between the source of fluid and the inlet of the control valve is equal to or greater than the pressure drop due to friction from the source to valve inlet plus the value from Fig. 1, the valve is sized for liquid flow with the available pressure differential equaling the total static head minus the friction drop in the piping from the source to the valve.

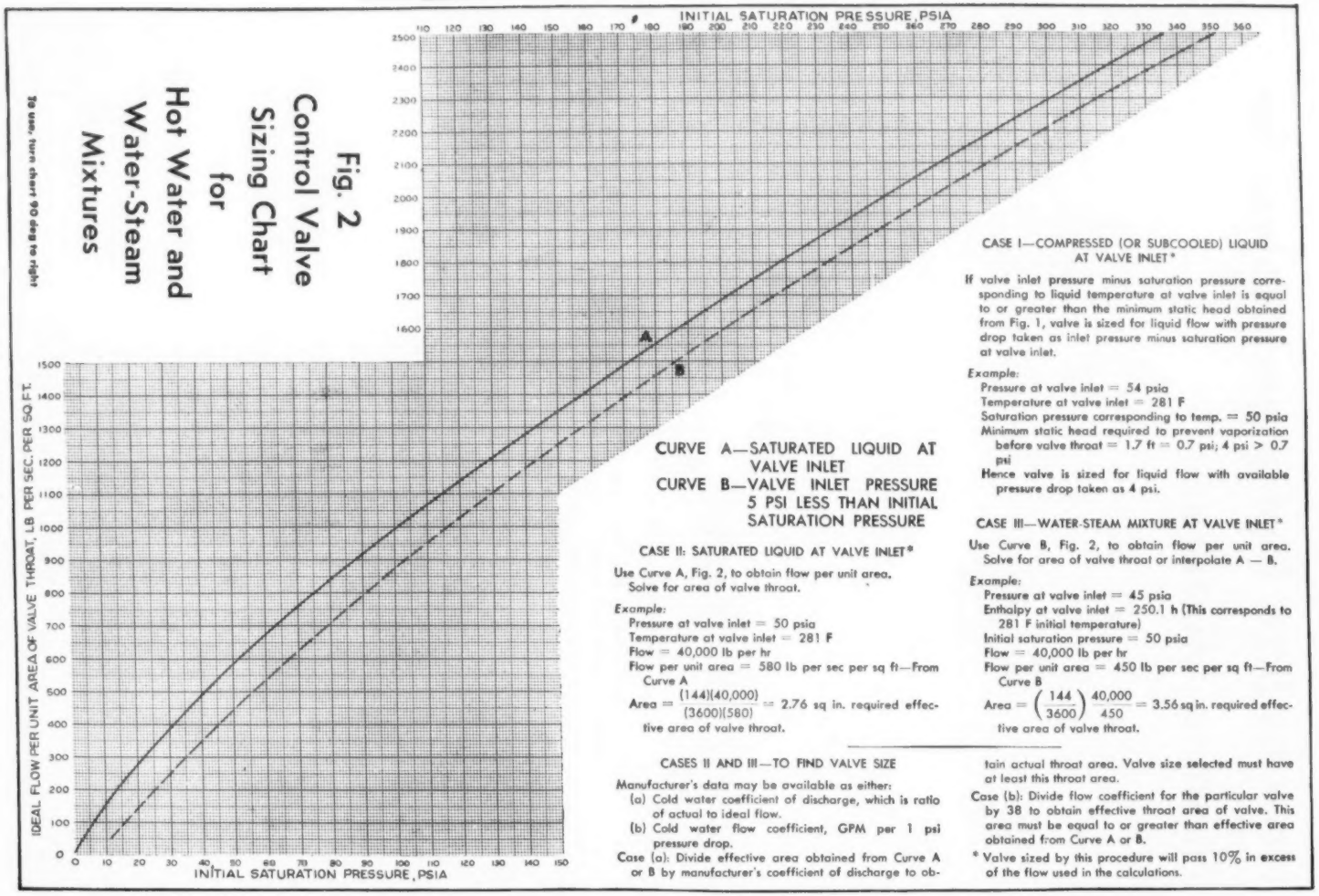
An example illustrating this procedure is given under Case I on Fig. 2. The procedure is valid unless the pressure at valve outlet is greater than initial saturation pressure, in which case the valve is sized for liquid flow with the available pressure differential taken as inlet pressure minus exit pressure.

The piping from the source to the valve is sized by the usual criteria for liquid flow.

The first step in determining the size of piping from valve outlet to the receiver is to investigate the possible existence of a critical pressure at the discharge end using formula 1. (See May issue, page 60.) In the usual case, it is desirable to design the line so that the computed pipe exit critical pressure is below receiver pressure in order to utilize the full pressure differential available. The constant C is computed with the subscript 1 referring to initial saturation conditions and the subscript 2 referring to conditions at receiver pressure and temperature.

Concurrently, for each pipe size investigated, the erosion criteria are applied. Using end-of-pipe conditions to determine mixture quality, the pipe size selected must be at least large enough so that the momentum force on 90-deg elbows is limited to

Fig. 2 Control Valve Sizing Chart for Hot Water and Water-Steam Mixtures


INITIAL SATURATION PRESSURE, PSIA
IDEAL FLOW PER UNIT AREA OF VALVE THROAT, LB PER SEC. PER SQ FT.
INITIAL SATURATION PRESSURE, PSIA
A
B

CURVE A—SATURATED LIQUID AT VALVE INLET

CURVE B—VALVE INLET PRESSURE 5 PSI LESS THAN INITIAL SATURATION PRESSURE

CASE I—COMPRESSED (OR SUBCOOLED) LIQUID AT VALVE INLET*

If valve inlet pressure minus saturation pressure corresponding to liquid temperature at valve inlet is equal to or greater than the minimum static head obtained from Fig. 1, valve is sized for liquid flow with pressure drop taken as inlet pressure minus saturation pressure at valve inlet.

Example:

Pressure at valve inlet = 54 psia
Temperature at valve inlet = 281 F
Saturation pressure corresponding to temp. = 50 psia
Minimum static head required to prevent vaporization before valve throat = 1.7 ft = 0.7 psi; 4 psi > 0.7 psi
Hence valve is sized for liquid flow with available pressure drop taken as 4 psi.

CASE II: SATURATED LIQUID AT VALVE INLET*

Use Curve A, Fig. 2, to obtain flow per unit area. Solve for area of valve throat.

Example:

Pressure at valve inlet = 50 psia
Temperature at valve inlet = 281 F
Flow = 40,000 lb per hr
Flow per unit area = 580 lb per sec per sq ft—From Curve A

$$\text{Area} = \frac{(144)(40{,}000)}{(3600)(580)} = 2.76 \text{ sq in. required effective area of valve throat.}$$

CASE III—WATER-STEAM MIXTURE AT VALVE INLET*

Use Curve B, Fig. 2, to obtain flow per unit area. Solve for area of valve throat or interpolate A — B.

Example:

Pressure at valve inlet = 45 psia
Enthalpy at valve inlet = 250.1 h (This corresponds to 281 F initial temperature)
Initial saturation pressure = 50 psia
Flow = 40,000 lb per hr
Flow per unit area = 450 lb per sec per sq ft—From Curve B

$$\text{Area} = \left(\frac{144}{3600}\right)\frac{40{,}000}{450} = 3.56 \text{ sq in. required effective area of valve throat.}$$

CASES II AND III—TO FIND VALVE SIZE

Manufacturer's data may be available as either:

(a) Cold water coefficient of discharge, which is ratio of actual to ideal flow.

(b) Cold water flow coefficient, GPM per 1 psi pressure drop.

Case (a): Divide effective area obtained from Curve A or B by manufacturer's coefficient of discharge to obtain actual throat area. Valve size selected must have at least this throat area.

Case (b): Divide flow coefficient for the particular valve by 38 to obtain effective throat area of valve. This area must be equal to or greater than effective area obtained from Curve A or B.

* Valve sized by this procedure will pass 10% in excess of the flow used in the calculations.

75 lb and the force intensity is limited to 300 lb per sq ft for horizontal runs and short vertical runs, and 30 lb and 150 lb per sq ft for vertical runs of more than 15 or 20 ft.

The pressure drop in the piping from the control valve to the receiver can be determined by using formula 2 (May issue, page 60) with a friction factor $4f = 0.012$ as previously reported in the literature (see Ref 2, end of article). Usually this will not be necessary, for a pipe sized large enough on the basis of the erosion criterion, or to avoid pipe exit critical pressure, will have a negligible pressure drop in the piping due to friction. The order of magnitude of this drop may be estimated by liquid flow formulas.

In using formula 2, the unknown is the pressure at control valve outlet inasmuch as p (without subscript) in the formula is the receiver pressure or calculated pipe exit critical pressure if greater than receiver pressure. The constants C_1 and C_2 are computed with the subscript 1 referring to initial saturation conditions at the source, and subscript 2 referring to conditions at receiver pressure or at calculated pipe exit critical pressure. The formula has to be solved by trial for the pressure at control valve outlet, p_1.

Case C — System in Which Saturated Liquid Water Enters Inlet of Control Valve: — The physical arrangement of equipment or other considerations may dictate that the control valve be located so that the fluid is in the saturated liquid state at the valve inlet. The ideal valve throat area can be determined by formula 3 (May issue, page 60). A value of the critical pressure ratio is estimated and a minimum of three calculations are made with critical pressure ratio varied from this value to show a maximum value of $W \div A$. The subscript 1 refers to the saturated liquid state and the subscript 2 refers to an estimated critical pressure condition at the valve throat.

However, with Fig. 1, May issue, available, only a single calculation is required, but the critical pressure ratios shown in Fig. 1 were obtained using this procedure.

Table II, May issue, furnishes an example of this type of computation, although slightly more complicated due to the fact the fluid had already flashed at valve inlet. In order to reduce the labor involved in valve selection, similar computations have been carried out for a wide range of values and the results plotted on Fig. 2, the Control Valve Sizing Chart. The complete procedure for use is given under Case II on the chart.

The piping from the source to the valve is sized by the usual criteria for liquid flow. The piping from the valve outlet to the receiver is sized by the procedure outlined under Case B which notes the information available on page 60 of the May 1952 issue.

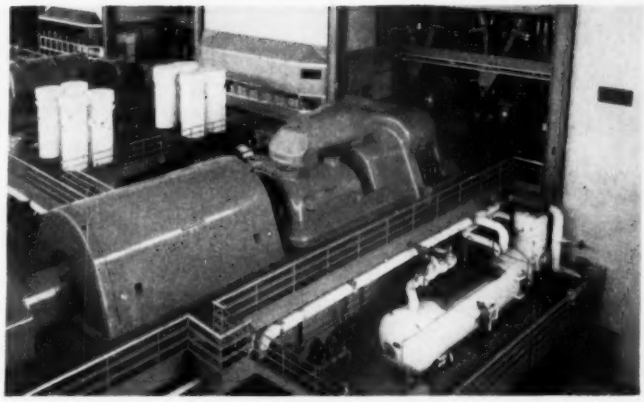


Fig. 3. Extraction heaters and other steam auxiliaries for some of the big new single-shaft turbine generators at a prominent central station. Design of piping and valves prevents erosion from flashing mixtures

Case D — System in Which Water-Steam Mixture Enters Inlet of Control Valve: — For long runs of piping, high initial pressures and pressure differentials of more than 30 or 40 psi between source and receiver, the preferred control valve location is adjacent to the receiver with a straight run of pipe from valve to receiver. This location results in an arrangement that offers the least possibility of erosion in the piping with the exception of the valve. The pressure drop due to friction, and perhaps a change in elevation in the piping before the valve with the consequent flashing, will increase its size above that required if it were located below the source heater, with a static head of liquid on the inlet. On the other hand, because all bends and elbows are located before the valve and, therefore, the erosive forces are reduced, the optimum size of piping between the source and receiver will be less when the valve is located adjacent to the receiver.

In many instances, if the valve is at the same elevation as the water level at the source, the pressure drop due to friction in the piping before the valve is not significant and the valve may be considered as under Case C. If the run of pipe is long and tortuous, so that pressure drop is significant, a satisfactory estimate may be made by considering the fluid as liquid from source to valve. If a precise value is desired, formula 2 has to be employed as under Cases B and C for the piping from valve to receiver. A large amount of flashing prior to the valve inlet usually is due to the valve being located at an elevation above the water level at the source.

Actual pressure at valve inlet may be determined for practical purposes by subtracting from the saturation pressure an amount equal to a static head of liquid corresponding to the difference in elevation between valve and source with a small allowance for friction. This is a conservative procedure, for the actual static head will be less than a static head of liquid because of the decreased density of the water-steam mixture in the vertical column.

The valve throat area can be computed by formula 3. Although the pressure at the valve throat is unknown, reference to the curve plotted in Fig. 1, May issue, gives a first estimate of pressure. In computing the constants and in solving formula 3, at least three values of critical pressure ratio less than the value from the curve are used to obtain a maximum value of $W \div A$. The constants are evaluated on the basis of an initial saturated state, while the pressure p_1 as it appears singly in the formula, corresponds to the pressure at the inlet of the control valve. Table II furnishes an example of this type of computation.

This type of calculation has been carried out over a wide range and the results are plotted on the Fig. 2 herewith. Thus, Curve B is for inlet pressure 5 psi less than initial saturation pressure. By interpolation between curves A and B and extrapolation up to perhaps 10 psi, the chart will cover nearly all cases. If the inlet pressure does not fall within 10 psi of saturation pressure, then the procedure outlined above involving formula 3 must be used.

The piping from the valve to the receiver is sized as under Cases B and C above.

References

1 — Derivation of formulas and other background material appeared in the paper Flow of a Flashing Mixture of Water and Steam Through Pipes and Valves by W. F. Allen, Jr., *Trans. ASME*, Vol. 73, 1951, pp. 257–265.

2 — The Flow of a Flashing Mixture of Water and Steam Through Pipes, by M. W. Benjamin and J. G. Miller, *Trans. ASME*, Vol. 64, 1942, pp. 657–669.

3 — Corrosion-Erosion of Boiler Feed Pumps and Regulating Valves at Marysville, Second Test Program by J. M. Decker, H. A. Wagner and J. C. Marsh; *Trans. ASME*, Vol. 72, 1950, pp. 19–26.

4 — The same characteristic is not displayed for flow through a sharp-edged orifice, as a vena contracta forms which varies in size with the pressure differential across the orifice.

5 — The control device may be wide open (boiler blowoff valve) and offer little or no resistance to flow. An adequate table for predicting capacity of unthrottled lines is given in Tube Turns' catalog.

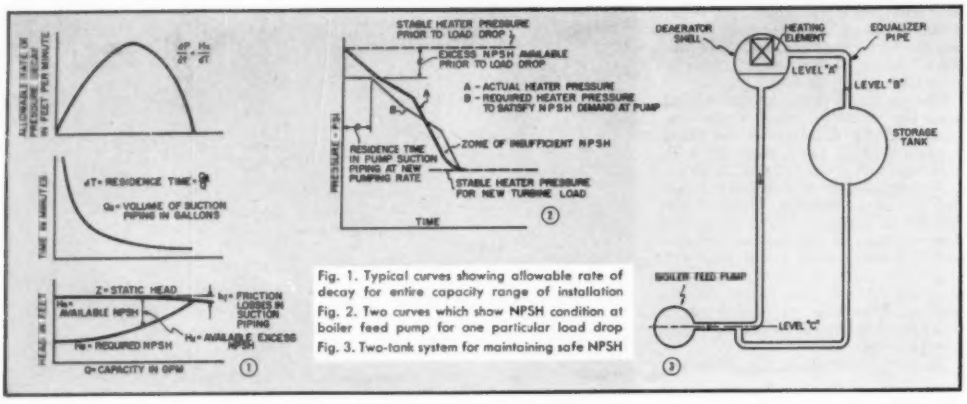

ALLOWABLE RATE OF PRESSURE DECAY IN FEET PER MINUTE
dT = RESIDENCE TIME = Qs
Qs = VOLUME OF SUCTION PIPING IN GALLONS
TIME IN MINUTES
Z = STATIC HEAD
hs = FRICTION LOSSES IN SUCTION PIPING
Ha = AVAILABLE NPSH
Hr = REQUIRED NPSH
Hx = AVAILABLE EXCESS NPSH
HEAD IN FEET
Q = CAPACITY IN GPM
1
STABLE HEATER PRESSURE PRIOR TO LOAD DROP
EXCESS NPSH AVAILABLE PRIOR TO LOAD DROP
A = ACTUAL HEATER PRESSURE
B = REQUIRED HEATER PRESSURE TO SATISFY NPSH DEMAND AT PUMP
ZONE OF INSUFFICIENT NPSH
RESIDENCE TIME IN PUMP SUCTION PIPING AT NEW PUMPING RATE
STABLE HEATER PRESSURE FOR NEW TURBINE LOAD
PRESSURE - PSI
TIME
2
DEAERATOR SHELL
HEATING ELEMENT
EQUALIZER PIPE
LEVEL "A"
LEVEL "B"
STORAGE TANK
BOILER FEED PUMP
LEVEL "C"
3

Fig. 1. Typical curves showing allowable rate of decay for entire capacity range of installation

Fig. 2. Two curves which show NPSH condition at boiler feed pump for one particular load drop

Fig. 3. Two-tank system for maintaining safe NPSH

How Sudden Load Changes Affect Centrifugal BF Pumps

By **I. J. KARASSIK,** Worthington Corp.
G. H. BOSWORTH, Bechtel Corp.
B. J. SCHMID, Pacific Gas and Electric Corp.

IN A POWER PLANT boiler feed pump, taking suction from a direct contact heater, sudden decrease of load on the plant may seriously reduce NPSH (net positive suction head) on the pump. Reasons for this, and resultant decaying heater pressure that may cause cavitation in the pump, were explained in detail by the authors in a paper before the American Power Conference in March. They showed that available and required NPSH and allowable rate of pressure decay may be as shown in Fig. 1.

Actual rate of pressure decay will be governed by the amount of heat and water stored in the heater, the rate at which water is entering and leaving the heater, and instantaneous enthalpy differences between water in and entering the heater.

Assuming a certain flow through the pump, it is possible to plot two curves, as shown in Fig. 2, which will give an indication of actual NPSH condition at the boiler feed pump at any time during a particular load. When the first curve dips below the second, NPSH requirements of the pump are not being met.

With constant final load, the higher the initial load, the more serious will be the reduction of NPSH. For a constant initial load, the relative effect is difficult to visualize, but certain concepts can be established. In any event, *rate* of NPSH reduction is most important in understanding this.

Two principal steps, within limits, can be taken by designers to increase the allowable rate of pressure decay and improve suction conditions. The first, elevating the deaerator or lowering boiler feed pumps, has obvious limitations. Sizing the connecting piping as small as practical and routing it as directly as possible is a controversial alternative.

Where basic design measures cannot help, mechanical means can be considered. Among them are: increasing heater storage; anti-flash baffling in the heater; a two-tank system; and use of protective controls.

Increasing heater storage lowers the rate of heater decay, but except for marginal cases is costly. Anti-flash baffling is basically an internal arrangement channeling water directly from heating element to pump suction piping.

The two-tank system, not as common as anti-flash baffling, employs a separate storage tank floating on the suction piping in parallel with the heater, as in Fig. 3. Water in this tank provides a source of cold feed which is automatically available to the pump when flashing takes place in piping from the heater. Heater storage should be kept to a minimum and heater discharge piping (down to where it is joined by the cold water tank piping) must be routed to permit return of vapor to the heater and should be sized to increase the residence time as much as feasible.

To assure adequate cold water for any load drop, the respective volumes of water stored in the heater and cold tank, as well as relative friction drops of the two lines down to where they join, must be carefully coordinated. Piping beyond this point must be routed and sized to preclude flashing.

Protective controls, least known and yet promising method, can increase available NPSH by two methods: increasing or maintaining minimum suction pressure for given vapor pressure, using an auxiliary source of steam; and reducing vapor pressure at the pump suction by injection of cooler water into the line.

Choice of the impulse method to control these effects must be made. One is based on selecting a safe rate of pressure decay and employing a measuring device to send an impulse when actual rate exceeds the allowable maximum rate.

The second, more direct and available in standard instruments, has one component which measures suction pressure and a second which measures vapor pressure at the pump suction. Difference is the available NPSH, which can be constantly weighed against the allowable value. Decay below what is required can then be made to actuate devices which protect installation against flashing.

The PRACTICAL ENGINEER *and* ELECTRICIAN

ANDREW W. KRAMER, EDITOR

WATER TREATMENT ENGINEERING

Every once in a while, we see a water treatment system in some small or medium-sized power plant that makes us shudder. Equipment squeezed into a small corner—obviously an afterthought. Piping and tanks coated with chemicals from leaks. Water and various chemical juices dripping on the floor. A general mess. Looks like something dreamed up by somebody with three thumbs on each hand.

Or—if the equipment is in good shape, which is often the case, the operating men don't really understand how to operate it properly.

Now there is a great difference between the mechanical design and operation of water treatment equipment and the fundamental chemistry on which the operation is based. This was forcibly brought out by Leo F. Collins in his now-famous article Engineering Problems of Water Treatment, POWER ENGINEERING, July 1946 issue.

There's plenty of help for the power engineer on the chemical side, to find out what treatment he needs and how to find out if it's working right.

But on the engineering side—how to handle the mechanics of the system—how it should be installed, arranged, operated—all too often there is not so much help. Or the engineer doesn't know how to use the tremendous knowledge of the water treatment companies to his best advantage.

So—we're going to help remedy that situation by a series of articles on Water Treatment Engineering. They will be of the most practical down-to-earth type, written by an engineer now in charge of operating several power plants and having wide experience in handling water under many different conditions. Watch for them in coming issues.

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Let Your Boiler Setting Walls Expand Vertically

In boiler setting walls no higher than 12 ft, experience showed that vertical expansion was an important factor. Expansion differential of firebrick and red brick resulted in cracking of the external wall. Recommended remedy is to build sectionally-supported firebrick linings by using a readily combustible filler in the firebrick construction

By H. D. FISHER, Consulting Engineer
Westcott and Mapes, Inc.

EXPANSION of the walls of boiler settings has been recognized for many years and most setting designs provide expansion joints at the corners, at intermediate points in the longer sides, and at the end of bridgewalls. In some of the larger boilers (80,000 lb per hr capacity and upwards) with refractory settings, the setting walls have been built two or three panels wide and high according to the size of the wall. Each panel is supported independently by steel work outside the setting. Such an arrangement is quite expensive and more recent practice has been to enclose the furnace with water wall tubes, backed up with refractory tile and insulation. This backing may in turn be enclosed in steel casing or covered with a layer of metal netting and insulating cement. Temperature of the refractory in this construction is held down to such an extent by the water wall tubes that expansion is not a serious problem.

For the small boiler, particularly of the horizontal return tubular type, the cost of any of these plans is prohibitive. A recent experience showed, however, that even for a solid masonry setting wall about 12 ft high some provision is desirable for avoiding damage to the wall caused by greater expansion of the firebrick lining at high temperature compared with expansion of the exterior red brick portion of the wall at a much lower temperature.

The Case in Question

This situation occurred at an installation consisting of three 84-in. hrt boilers set in a single battery and arranged for oil firing. The bottom of the shell of the boilers was set about 8 ft above the floor and total height of the setting walls was about 13 ft. Stepped vertical expansion joints were provided at each corner of the setting and in the middle of the front and back walls. Pockets were also provided in the front and back walls at the ends of the middle walls, and in the side and middle walls at the ends of the bridge walls. All expansion joints were $\frac{3}{4}$-in. wide and packed with corrugated asbestos board.

Frequent inspections were made during the laying up of the setting and it was a first class job of mason work. The setting was dried out slowly and carefully — taking about 5 days. Very small oil burner tips, and at first intermittent firing, were used to limit the rate of heating.

After the boilers had been in service several days, horizontal cracks were noticed in the side walls about 5 ft above the floor and extending from slightly back of the front wall to about 3 ft back of the bridge wall. The cracks were about $\frac{1}{4}$-in. wide. At first it was thought the cracks were due to pressure from the bridgewall, but there was no outward displacement of the wall. It was finally decided they must be due to the greater expansion of the firebrick lining raising the upper portion of the wall by means of the bonding courses which were laid up as shown in Fig. 1. This opinion was confirmed by observation that the cracks narrowed noticeably when the adjacent outer boiler was out of service.

Another check of the validity of this theory is to calculate the amount of differential expansion to be expected between the timing and outer brickwork.

Coefficient of Expansion

Considerable data is available on the coefficient of expansion of fire clay brick at all temperatures up to full boiler furnace temperatures, but very little has been published on the expansion of red brick. After considerable research several investigations by the Bureau of Standards, see references (1), (2) and (3) at end of article, were located. These were undertaken primarily in connection with building problems, and the temperature range of most of the tests was comparatively small and at ordinary temperatures. One set of tests, in connection with the fire resistance of hollow tile, did cover a wide range (32 to 572 F). As would be expected with materials of such widely varying sources and composition, the coefficient of expansion varied. The average for bricks made of surface clay and shale, however, was quite uniform in several series of tests and amounted to 3.4×10^{-6} per 1 F, varying between 2.3 and 6.9×10^{-6}. This was true both for the atmospheric temperature and the higher temperature range. As a rule the shale bricks showed much greater uniformity than the surface clay bricks.

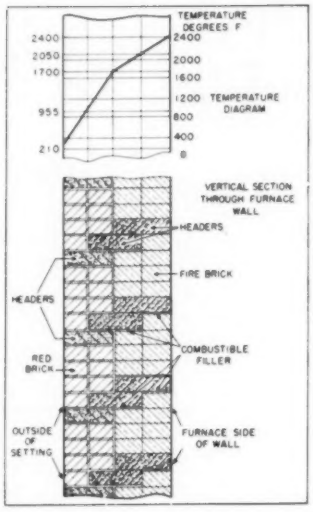


Fig. 1. Vertical section through a furnace wall showing distribution of temperature through the wall (top), and placement of continuous horizontal joints of combustible filler for vertical expansion

Suggested Expansion Remedy

One set of investigations (2) showed that denser, harder burned bricks from the same batch, as shown by lower porosity and lower water absorption, had lower coefficient of expansion. More extreme ranges were from 2.2 to 3.6×10^{-6} for a water absorption range of 11.5 to 17.5 per cent, and 3.8 to 4.7×10^{-6} for an absorption range of 18.4 to 25.1 per cent.

Some bricks of fire clay were included in these tests and showed coefficients of expansion of 2.0 to 2.2×10^{-6} per 1 F, except in one short series where the average was 3.1 and the range 1.9 to 3.8×10^{-6}.

It would therefore appear that the coefficient of expansion of red brick is about $1\frac{1}{2}$ times that of firebrick. This can be explained by the presence of relatively large proportions of sand in the surface clays with correspondingly greater expansion — silica brick being known to have a much greater coefficient of expansion than firebrick at temperatures up to 1000 F.

Temperature distribution through the wall can be estimated from the conductivities of the materials. Ac-

cording to various authorities, these are (in Btu per sq ft per degree F per hr for 1 ft thickness):

	Perry (4)	Marks (5)	Used in Calculation
Red brick	0.4	0.33–0.42	0.40
Firebrick	0.63	0.70–1.00	0.85

Assuming wall temperature in the furnace to be 2400 F, heat transmission would be 330 Btu per sq ft per hr, and outer wall temperature 210 F which is in accordance with observed conditions. The temperature at the joint between the red brick and firebrick would then be 1700 F, and the average temperatures would be 2050 F for the firebrick and 955 F for the red brick as shown in Fig. 1. Average expansion of the firebrick would be .0661-in. per ft and of the red brick .0357-in. per ft — a differential expansion of .0304-in. per ft. For a wall 5 ft high this would amount to 0.1665-in., or the same order of magnitude as the width of the cracks observed in the wall.

A proposed remedy for this kind of expansion trouble is shown in Fig. 1: that is, to place in each fifth joint on the fire side a piece of cardboard or building paper about $^1/_{32}$-in. thick which will burn out when the boiler is fired. The wall then will have, in effect, a sectionally supported firebrick lining, each section being 5 courses high and individually supported on the red brick outer portion of the furnace wall.

If it is argued that the headers joining the firebrick and red brick portions of the wall will not support this load, there is the evidence that they lifted the outer red brick portion of the boiler wall as has been described. Calculation shows that the modulus of rupture of the loading brick would be 506 lb per sq in., which is well below the breaking strength of many fire bricks.

References

(1) Bureau of Standards, Research Paper No. 37, Fire Resistance of Hollow Wall Tube
(2) *Do.*, No. 321, Volume Changes in Brick Masonry Walls
(3) *Do.*, No. 1414, Thermal Expansion of Clay Building Brick
(4) L. S. Marks, Mechanical Engineers Handbook
(5) J. H. Perry, Chemical Engineers Handbook

Extraction Calculations for Bleeder Turbines

Complexity of feedwater heating piping can make extraction calculations difficult . . . Here the author summarizes the long and short of such calculations . . . Long method, using heat balance formulas, can be used for all types of extraction problems . . . Short method, relying on 6 basic piping arrangements, can be used for solving quickly most of the common extraction problems likely to be encountered

By C. B. SCHUDER, Test Engineer
Central Illinois Public Service Co.

RAPID INCREASE in capacities of turbo-generator units makes the necessity of close checks on performance more and more important. Day by day records are useful, but periodic turbine tests will provide a more reliable indication that load is held constant and auxiliary uses of steam and condensate are eliminated or held to close tolerances.

Majority of the calculations involved in a turbine test are relatively straightforward. However, complexity of present day feedwater heater piping can make extraction calculations rather difficult.

For simplicity in calculating it is desirable to start with the boiler feed meter, or meters, and work back to the condenser. In this way heat flashed by the heater drains is always known for the heater under consideration.

Consider first the simple case of a closed heater, as in Fig. 1, having heat added only from extracted steam and flashing drains back to a lower pressure heater.

Fig. 1. Diagram of simple case of a closed heater

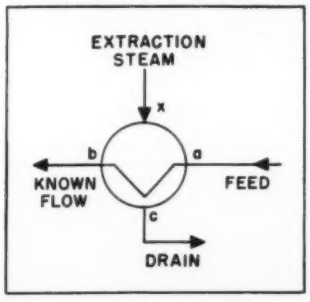
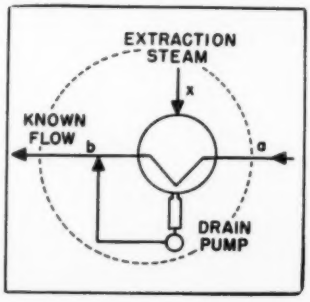


Fig. 2. Drains back into the feed line after heater



Heat picked up by the feed is equal to heat lost by extraction — so the extraction flow (lb per hr) must equal the total heat added to the feed (Btu per hr), divided by the available heat in the extraction

Formulas

Where: M_x = extraction flow (lb per hr)
M_f = known feed flow (lb per hr)
h_a, h_b, h_c, h_d, etc. = enthalpy of fluid at points indicated by subscripts

(1) $$M_x = \frac{M_f\,(h_f - h_a)}{h_x - h_c}$$

$$M_a h_a + M_b h_b = M_f h_f$$

Substituting $(M_f - M_a)$ for M_b:

$$(M_f - M_a)\,h_a + M_a h_b = M_f h_f$$

Simplifying and collecting terms:

$$M_a\,(h_a - h_b) = M_f\,(h_f - h_b)$$

Giving for the extraction:

(2) $$M_a = M_f \frac{(h_f - h_b)}{(h_a - h_c)}$$

Heat balance around both:

(3) $$M_x h_x + M_y h_y + M_f h_f = (M_x + M_y + M_a) h_d$$

Heat balance around No. 1:

(4) $$M_x h_x + M_y h_y + M_f h_f = (M_x + M_y + M_a) h_c$$

Combining like terms:

(3a) $$M_x (h_x - h_d) + M_y (h_y - h_d) = M_a\,(h_d - h_a)$$

(4a) $$M_x (h_x - h_c) + M_y (h_f - h_c) = M_a\,(h_c - h_a)$$

Multiplying (4a) by $\frac{h_x - h_d}{h_x - h_c}$:

(4b) $$M_x\,(h_x - h_c) + M_y (h_f - h_c) \left(\frac{h_x - h_d}{h_x - h_c}\right) = M_a\,(h_c - h_a) \left(\frac{h_x - h_d}{h_x - h_c}\right)$$

Subtracting (4b) from (3a) to eliminate M_x:

(5) $$M_y (h_y - h_d) - M_y (h_f - h_c) \left(\frac{h_x - h_d}{h_x - h_c}\right) = M_a\,(h_d - h_a) - M_a\,(h_c - h_a) \left(\frac{h_x - h_d}{h_x - h_c}\right)$$

Solving for M_y:

(6) $$M_y = M_a \frac{(h_d - h_a) - (h_c - h_a) \left(\frac{h_x - h_d}{h_x - h_c}\right)}{(h_y - h_d) - (h_f - h_c) \left(\frac{h_x - h_d}{h_x - h_c}\right)}$$

Solving equation: (4a) for M_a:

(7) $$M_a = \frac{M_x\,(h_c - h_x) - M_y\,(h_f - h_c)}{h_a - h_c}$$

steam (Btu per lb). See Equation 1.

If, however, no lower pressure heater is available to receive the drains, they may be pumped into the feed line after the heater, as in Fig. 2.

Solution here is not so apparent. Flow through the heater will not be known until the extraction is calculated, and the extraction cannot be found without a knowledge of the flow. In such a situation it is necessary to write a heat balance: either around the area enclosed by the dotted line in Fig. 2 or around an area including only the heater. The first method leads to a more convenient form and will be used to illustrate the procedure. The same notations are used, and the heat into the area is equated to the heat out. See Equation 2 for explanation.

Results of heat balances on different heat piping arrangements can be reduced to six general formulas, Fig. 3, in a like manner. These formulas will cover the majority of problems encountered, and can be considered a so-called short method of extraction calculations. Use of these formulas is limited to those calculations which can be started with the highest pressure heater.

Occasions may arise, however, where it is necessary to work part of the way from the lowest pressure heater. This may be because of a reluctance to sectionalize in the case of multiple units, or a desire to work both ways to the boiler feed pumps in order to have any loss or gain in water appear at that point. Such calculations may be made provided, of course, that the condensate flow is metered. A typical case is shown in Fig. 4.

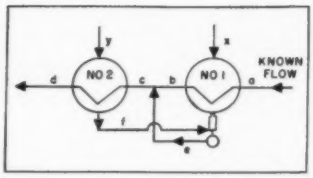


Fig. 4. Heat balances used to solve typical case

Flow is known through heater No. 1, but heat flashed by drain No. 2 is unknown, so there is no solution for this heater alone. Likewise, heater No. 2 cannot be solved until drain No. 1 is known. The problem may be solved, however, by writing two independent heat balances in terms of the unknown extractions and solving simultaneously. See Equations 3-7.

Known flow and enthalpies are substituted in Equation 6 to determine the value of M_y (heater No. 2 extraction), which is in turn placed in Equation 7 to determine M_x (heater No. 1 extraction).

This problem illustrates only one of many heater combinations that can be solved using simultaneous equations. Some combinations involve 3 unknowns and require 3 independent equations.

As a word of caution at this point, note that both problems in Fig. 2 and 4 could have been simplified by writing an equation around the point where the drains are pumped into the feed lines. Temperature increase of the feed at this point is usually less than 1 F. However, so very small an error in temperature measurement could easily result in an extraction flow error of large proportions.

Development of formulas for turbine test calculations is in some cases a rather tedious job, but it is much to be preferred over trial and error methods for an accurate answer.

SHORT METHOD FOR SOLVING MOST EXTRACTION PROBLEMS

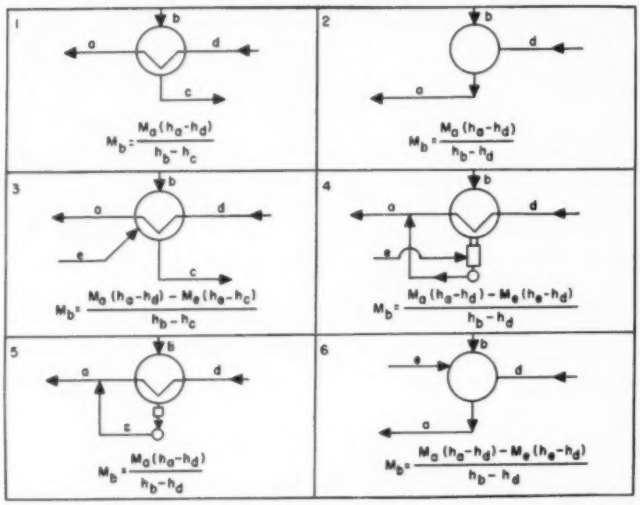


Fig. 3. M = flow, lb per hr, at point indicated by subscript; h = enthalpy, Btu per lb, at point indicated by subscript. Subscript a = feed to boilers or as calculated as entering next higher pressure heater; b = extraction steam; c = heater drain; d = feed entering heater; and e = drain flashed back from higher pressure heater. These are the quantities you will need for extraction figuring in the above cases. Start with highest pressure heater and work back to condenser. Pick the heater type from the diagrams

R for Sulphated Batteries

A "SULPHATED" BATTERY is one which has been left standing in a discharged condition or undercharged to the point where abnormal lead sulphate has formed on the plates. When this occurs the chemical reactions within the battery are impeded.

Thorough and careful attention to the following steps often will restore a sulphated battery to good operating condition: 1. Clean the battery and bring electrolyte level to proper height by adding water. 2. Charge battery at the prescribed finishing rate until the full ampere-hour capacity based on the 8 hr rate is reached. Battery temperature at this time must not exceed 110 F. Reduce the charge rate to keep temperature of the battery at or below this point. If any cell reads 0.20 v less than the average cell voltage of the battery, repair this cell before continuing.

3. Place battery on discharge at the 8 hr rate and record individual cell voltage at the following intervals: 15 min after start, then hourly until voltage on one cell reads 1.80 v and from then on at 15 min intervals. 4. From this point on the cell voltages should be under constant observation and the time recorded when cell voltage goes below 1.75 v. 5. Terminate the test discharge when the majority of the cell voltages reach 1.75 v but stop before any single cell reverses.

6. If the battery gives rated capacity, no further treatment is required other than normal recharge and equalization of gravity. 7. If the battery does not deliver near-rated capacity, continue the discharge without adjusting the discharge rate until one or more cells reach 1.0 v. 8. Recharge the battery at the finishing rate as described above, again charging until there is no further rise in specific gravity over a 4 hr period, readings being taken hourly.

9. Discharge again at the 8 hr rate and if the battery gives full capacity, recharge and put into service.

10. If this procedure does not result in full capacity, it should be repeated once more with proper care.

Fear and Dizzy Spells Mean Danger For The Lineman

By DR. W. SCHWEISHEIMER

ELECTRIC LIGHT and power linemen show an unusually high accident rate. One fifth of those accidents are the result of falls!

Falls can be attributed generally to three causes: the first of very basic nature; the other two secondary only in scope.

The basic cause of falls is evident. Linemen who work in high places such as bridges, towers and poles need technical know-how; but they also need the *ability* to work safely at those dizzy heights. Safety belts are axiomatic, but they don't give a lineman inherent poise so necessary off the ground. Not every lineman who does excellent work on the ground is able to perform satisfactorily at 10 ft or 100 ft.

Fear of Height

R. Jarman recently described the difficulty in choosing a repair crew of 60 men for the George Washington Bridge.

Only 400 of the 700 applicants passed the medical and psychological tests. Safety measures there included nets and belts wherever possible, constant observation by a foreman, and a ban on smoking. All new workers were accompanied by two "old hands" who observed their reactions, and brought them to safety if they should "freeze."

Only 30 of the 400 remaining were able to scramble about the bridge framework with sufficient nonchalance to qualify. One man who had worked on tall New York skyscrapers for years could not stand work on the bridge — the absence of solid walls destroyed his calmness.

Presupposing most linemen are able to work in high places, they still remain prone to falls. Better care for the life and safety of those so fitted can be achieved from two directions: the equipment, and the man himself.

Dizziness, for a variety of reasons, spells danger in high places. In a true attack of dizziness there is a sensation as if objects were rotating around the body, or as if the body itself was rotating. There is also a temporary loss of equilibrium, most often responsible for falls or slips.

Often dizziness is caused by severe physical or mental strain, long hours of work or insufficient sleep. Other common causes are too much smoking or other excesses, general weakness after sickness, anemia, thin blood. Chronic constipation can be responsible for dizziness.

Dizzy spells, particularly among middle-aged linemen, are reason enough for a complete check-up. They are frequently the first signs of heart, high blood pressure or ear trouble.

Some dizziness may be caused by nervous tension, without any change in the condition of the organs. Most troubles of this kind disappear under proper treatment. In any event, as long as dizzy spells persist, no lineman should get off the ground.

Well-adjusted glasses for nearsighted or farsighted persons are indispensable to safety in high places. Some men may even require two pairs of glasses — one for normal distances, another for short range. Carelessness or laziness about glasses may well result in improper judging of distance or blurred vision, both responsible for falls.

Defective Equipment

Careless use of scaffolds, safety belts, ladders, step stools, etc., or the use of defective ones, will result in disastrous falls. There is evidence that accidents resulting from the use of such equipment in the building trades, including installation of electric equipment, were nearly 2½ times as frequent as in other industries. In New York City alone this kind of accident accounted for more than 50 per cent of all accidents. Negligent use and maintenance of equipment is not solely responsible for the high rate of falls, but shares the blame with the other causes — fear of high places and temporary dizziness.

Utilities and industrial plants today are far more safety conscious than in former times. But the fact remains: the accident rate from the commonest of causes, falling, is high.

Preventing Tube Failures In Water-Tube Boilers

Bulges and ruptures in tubing are reason for most watertube boiler failures . . . Tube scale or improperly adjusted combustion equipment is usually the cause . . . Here's how to prevent these troubles

TUBE FAILURES and tube bulges are the most common defects in watertube boilers according to the Mutual Boiler Insurance Co. In a recent analysis, these defects were found responsible for 32 per cent of all boiler repairs, and in many instances forced shut-downs resulted.

While repairs for bulging of a tube are usually classed under plant maintenance, need for such repairs does not reflect good operation. The bulging of tubes is the result of a condition that can well lead to violent rupture of a tube, often taking lives.

Bulges can be prevented. In order to prevent them, the causes must be thoroughly understood and then proper steps taken to eliminate these causes.

Fundamental cause of practically all tube bulges is overheating. The modern watertube boiler operates with high temperatures in the furnace and with heat input to the tubes at a far higher rate than firetube boilers, such as the hrt boiler.

Effects of Tube Scale

Scale of up to ⅛-in. in thickness on the tubes in an hrt boiler is little cause for concern — other than for the increase in fuel consumption. However, in a watertube boiler operating at high ratings, even 1/16-in. of scale can cause bulges in tubes.

Scale formation is often in such dense, compact layers that it insulates the inside of the metal from the cooling effects afforded by direct contact of boiler water. This interruption of heat flow causes the temperature in the tube wall to rise beyond safe limits. The chart illustrates the effects of interrupted heat flow on temperature.

If scale builds up to a greater extent, if it is dense such as silica scale, if it is contaminated with oil or if it is due to faulty combustion, heat input is excessive and bulging will result. Tube-wall temperatures rise so high that the metal often approaches red heat. It becomes too weak to resist internal pressure, which causes the tube to bulge outwards. Sometimes the scale cracks up as the tube-wall deforms and boiler water again comes in direct contact with the metal. The bulge may be arrested temporarily, but particles of loose scale or sludge may accumulate in the pocket thus formed. Then the temperature of the metal again rises to the point of weakness and the bulge progresses. Usually, this ac-

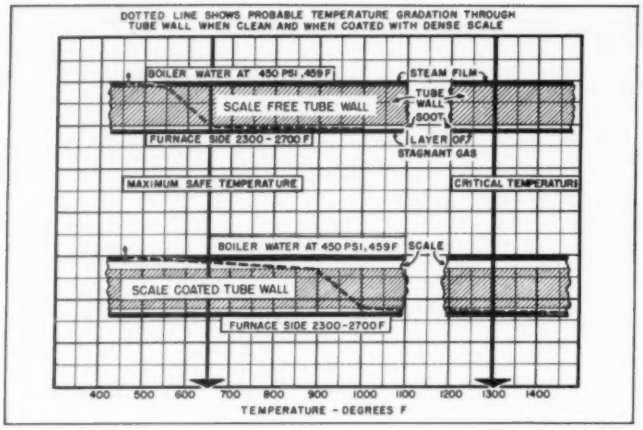

DOTTED LINE SHOWS PROBABLE TEMPERATURE GRADATION THROUGH TUBE WALL WHEN CLEAN AND WHEN COATED WITH DENSE SCALE
BOILER WATER AT 450 PSI, 459 F
STEAM FILM
SCALE FREE TUBE WALL
TUBE WALL
SOOT
FURNACE SIDE 2300 - 2700 F
LAYER OF STAGNANT GAS
MAXIMUM SAFE TEMPERATURE
CRITICAL TEMPERATURE
BOILER WATER AT 450 PSI, 459 F
SCALE
SCALE COATED TUBE WALL
FURNACE SIDE 2300-2700 F
400 500 600 700 800 900 1000 1100 1200 1300 1400
TEMPERATURE - DEGREES F

Chart showing how scale formation, insulating tubes, causes overheating—resulting in bulges or ruptures

tion continues until the tube-wall has stretched too thin to resist pressure and a rupture results.

If the bulge is the result of scale, immediate steps should be taken to correct the condition. It is far better to recognize scale conditions in the beginning so that build-up of scale may be prevented.

Feedwater Treatment a Must

Controlled feedwater treatment is absolutely essential for scale prevention. Daily tests of the boiler water should be made and proper chemicals introduced, if required, proportioned on the results of the daily tests. The amount and frequency of blowing boilers down should also be controlled by results of the daily boiler water tests to limit concentration of solids in the boiler water.

Controlled feedwater treatment should simultaneously retard or prevent internal corrosion or pitting. The cost is usually more than offset by increased savings in fuel consumption and by prolonged useful life of the boiler.

If scale conditions have gotten out of hand because of lack of, or inadequate, boiler water treatment, the scale should be removed by mechanical means or by acid cleaning. The latter should be done under the direction of an experienced chemical engineer so no damage will result.

Once scale has been removed, water treatment as described should be inaugurated to prevent any repetition of scale build-up.

Combustion equipment may contribute to bulged tubes. When firing with oil, pulverized coal, or gas, the burners should be adjusted so there is no flame impingement. Flame impingement may cause such a high rate of heat input that water is actually driven away from the internal surfaces of the tube. Steam blanketing results and the tube-wall may be overheated to the extent that bulges occur. If the tube-wall is alternately overheated and chilled by splashing on of boiler water, quench cracks may result. Flame impingement may also result with automatic stokers, or even with hand firing of coal, if a blowhole in the fuel bed permits forced draft from beneath to blow the flame directly on the tubes.

When burning low grades of coal, excessive slag formation may bridge the tubes and permit a blow-torch action through holes in the slag. This flame impingement will have exactly the same results as that from faulty burners.

In repairing a bulge that is not deep or burned, the bulged areas should be heated to dull red heat and set back to original curvature by hammer blows. A 2 or 3 lb hammer is used, striking round the periphery of the bulge, gradually reducing it in size. It is important that the bulge be kept at red heat while working it back so as to keep it above the range of "blue brittleness" which occurs at 300 to 700 F.

If a bulge is burned or deep, it becomes necessary to cut out a short length of tube containing the bulge and to weld in a new length. The new piece of tube should be of the same material and thickness as the original tube and a backing ring should be used, unless a sound weld can be produced without it. The abutting edges should be bevelled to form an included angle of about 45 degrees. In some instances, a bulge has been cut out and a new piece of tube flush-welded in place satisfactorily. This technique demands an expert welder.

Care of Leather Belts

To ASSIST in the preservation of leather belt drives, the American Leather Belting Association offers the following summary of good practice in belt care.

Cleaning. Polishing of pulley faces indicates the need for dressing on the belt. Under normal conditions, belts should be dressed every 3 to 6 months, using a belt dressing designed to replace oils lost from the belt in use or during cleaning.

Belts should be kept as clean as possible at all times, since oil or grease thrown from machine bearings will reduce belt life and pulling power. Installation of deflectors or grease flinger discs on machine shafts will help.

A small amount of oil on a belt is usually easily removed by wiping it off. If this is not successful, scrub the belt thoroughly with a solution of carbon tetrachloride and naphtha, using a stiff jute brush. Take care to work the brush in the direction of the lap joints, to prevent lifting them.

Tension. Keep the belt tight enough at all times to transmit power without slippage. A slack belt will slip and burn; an overly-tight belt places undue strain on the shaft bearings.

Alignment. Belting cannot give good service if pulleys or shafting are out of line. Misalignment is indicated when the belt runs off the pulley at one side, or rubs and climbs on flanged or step-cone pulleys. To determine whether the fault is alignment or a crooked belt, turn the belt inside out or end for end. If the belt still runs to the side of the pulley, the fault is undoubtedly in pulley alignment.

Drive alignment should be checked at least once a year. In multiple story buildings, shifting of loads on a floor above a shafting run may distort the shaft or throw it out of line. Other common faults in drive alignment are: shafts carrying driving and driven pulleys may not be parallel; shafting may be sprung out of line; driving and driven pulleys may be offset; the pulley may be eccentric with the shaft.

Laps. Re-cement immediately any laps showing signs of opening. Belt guards, shifter, guides, or flanges may run against the side of the belt and open up the plies. One guard against the possibility of rubbing is use of broad, well-rounded belt shifters and guides, which spread their thrust over a large belt edge area. Another lap-spreading fault is the use of small diameter pulleys for thick belts. Belts are unduly strained as they pass over the small pulley, and the plies tend to separate. All the above result in good belting service for you.

Helpful Checklist for Boiler Overhauling

Overhauling a boiler is a long and often complicated task. It must be done without delay and with a minimum of confusion. Here is a practical checklist devised by the author while a boiler-room engineer. Use of such a list can take a lot of the guesswork out of a big job

By SAMUEL R. GREEN

1. Secure necessary supplies for overhaul.
2. Ready all cleaning tools and equipment for use.
3. Connect all steam lines in preparation for boiling out.
4. Prepare boilout charge.
5. Obtain clearance when boiler is off the line.
6. Charge boiler and boil out for 36 hr. Cool boiler down.
7. Wash down air preheaters, induced draft fan and fan housing.
8. Clean forced draft fan and fan housing with wire brushes.
9. Overhaul all steam, water column, safety and blowdown valves Repack and renew stems where necessary.
10. Overhaul all sootblowers and set for correct rotation. Check hangers. Renew worn or defective sootblower parts.
11. Inspect air preheater tubes and housing. Check top and bottom passes, ducts, etc.
12. Inspect forced and induced draft fan blades and housing.
13. Inspect all boiler baffles; repair if necessary.
14. Inspect fire box. Repair or replace defective air registers and oil burner diffusers.
15. Make necessary repairs to furnace brick work.
16. Remove and recondition all water glasses and high-low water alarm whistles.
17. Remove all scrubbers, if any; buff drums; turbine the boiler and water wall tubes.
18. Inspect main feedwater stop valves and repack stems.
19. Inspect boiler feedwater pressure differential valve and repack stem. Oil operating mechanism, clean water passage ports, and check diaphragm, bellows, etc.
20. Clean and check fuel oil differential pump, motor bearing and coupling. Replace worn parts.
21. Clean and check solenoid operated fuel oil stop valve.
22. Clean motor, oil circuit breaker and emergency trip on forced and induced draft fans.
23. Inspect, check clearances and repair all bearings, couplings, coupling bolts and bushings on forced and induced draft fans. Renew oil in motors and fan bearings.
24. Inspect damper drive motors, controls, linkage, gear boxes, etc.
25. Inspect and clean all automatic combustion controls, meters and recorders.
26. Clean and check fan bearing oil circulating pump, motor switch and wiring.
27. Clean and check all electrically operated remote control wiring and circuits on boiler firing panel.
28. Air lance boiler. Repair air leaks in setting.
29. Inspect boiler internal with boiler inspector.
30. Close boiler drums and handhole plates, gag all safety valves, and put hydrostatic test on boiler (1½ times the working pressure).
31. Inspect boiler externally with boiler inspector. Note leaking tubes.
32. Reduce boiler pressure slowly back to zero. Make repairs necessary to prevent leaks noted. Put hydrostatic test on boiler again—bring pressure back to zero if boiler is tight.
33. Megger out forced and induced draft fan motors. If no grounds appear return clearnace to Chief Engineer.
34. Remove tools and equipment on or near boiler.
35. Calibrate all pressure gauges while boiler is brought up to pressure. Blowout all steam and water lines to the steam and water flow meters.
36. Warm up main steam line while boiler is being brought up to pressure. Open main steam header stop valve and close off steam header drain valves.
37. Gag all boiler safety valves but one. Install calibrated steam pressure gauge to boiler drum vent after pressure reaches 50 psig.
38. Assemble tools and stand by to test and reset safety valves.
39. Set all safety valves correctly, then allow pressure to fall below operating normal. Open boiler non-return and stop valve, light off the fire in boiler, and let boiler come in on line automatically.
40. Make complete overhaul report. List time, material and major overhaul work scheduled for next overhaul. Report should be made in duplicate.
41. Check, clean and repair all tools and equipment. Order any replacement parts needed.
42. Requisition parts needing replacement, such as valve stems, valve packing, gaskets, brick, cement, fire clay, baffle tile, soda ash, soap, etc.
43. Finally, but most important, thank those who helped, and get 16 hr sleep.

Don't Neglect Maintenance of Insulation

INSULATION MAINTENANCE, a neglected factor in many plants, often leads to costly heat losses or operating inefficiencies. Need for maintenance may result from normal wear and tear, from failure to repair or replace insulation damaged or removed during alterations, or from routine equipment maintenance work.

Most frequently, the need for insulation repair on pipe lines can be noticed around flanges and fittings opened for inspection or other purposes. Pipe insulation adjacent to chain hoists, doors or other moving objects may be damaged if not properly protected. Loose tie wires or bands and damaged canvas coverings should be checked and repaired. Small fittings insulated with cement are more likely to need periodic reinsulation than pipes and larger fittings having molded insulation.

Fig. 1. Typical equipment service opening where insulation is subject to damage during normal use

Equipment is likely to show most need of insulation repair around manholes or other openings where the edges are subject to hard contact and abrasion. Vibrating or rotating equipment, when insulated, should be checked frequently to assure soundness of fastenings. Loose tie wires or sheared stud welds may permit insulation to sag or become completely detached.

One factor causing neglect of insulation maintenance is lack of proper stocking of insulation materials of various types and sizes. This problem can be solved by arranging for periodic inspection and maintenance. Plants following such practice find that it more than pays for itself through prolonged life of the insulation and added fuel savings.

A 96-page manual describing and illustrating application and maintenance techniques can be obtained by writing the Magnesia Insulation Manufacturers Association, 1317 F Street, N.W., Washington 4, D. C.

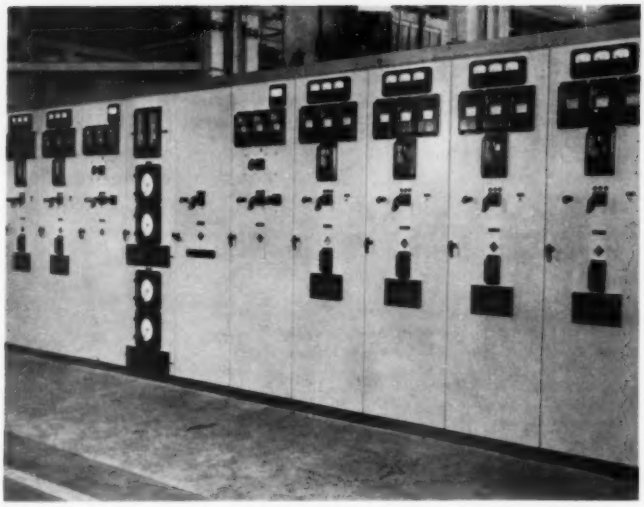


Fig. 1. Typical line-up of switchgear which can be accurately detailed by using simple specifications

By DARIO DALASTA
Switchgear Section
Allis-Chalmers Mfg. Co.

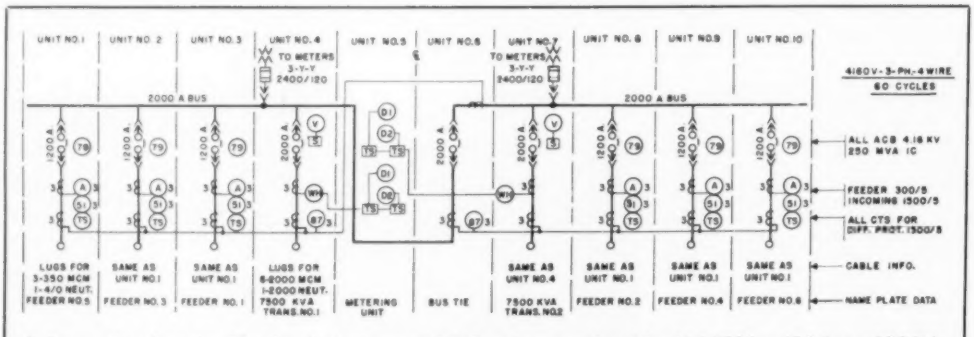
Specify Your Switchgear—the Easy Way

LONG, DETAILED specifications of equipment went out when standardization came in. As regards switchgear, not only were types and variety reduced, but activities associated with the equipment, from manufacture to replacement, were also simplified.

Because the term metal-clad has industry-wide acceptance, its use with a single line diagram and certain explanatory information, Fig. 1, is sufficient to provide a brief but complete switchgear specification. This compact specification is more exacting and less apt to be misunderstood than the exasperating 40 or 50 page tomes of not-too-long-ago. In addition, explanatory information in today's simplified version shows vital facts frequently omitted from the drawn-out specifications of the past.

A line-up of switchgear such as shown in Fig. 2 can be designed, assembled and shipped with no more information than that contained in the single line diagram specification.

Fig. 2. Modern switchgear specifications contain all of the necessary data in only a single-line diagram (top) and certain explanatory information (at bottom)


UNIT NO.1
UNIT NO. 2
UNIT NO. 3
UNIT NO. 4
TO METERS 3-Y-Y 2400/120
UNIT NO.5
UNIT NO.6
UNIT NO.7
TO METERS 3-Y-Y 2400/120
UNIT NO. 8
UNIT NO.9
UNIT NO.10
4160 V-3-PH.-4 WIRE 60 CYCLES
2000 A BUS
2000 A BUS
ALL ACB 4.16 KV 250 MVA IC
FEEDER 300/5 INCOMING 1500/5
ALL CTS FOR DIFF. PROT. 1500/5
CABLE INFO.
NAME PLATE DATA
LUGS FOR 3-350 MCM 1-4/0 NEUT. FEEDER NO.5
SAME AS UNIT NO.1 FEEDER NO.3
SAME AS UNIT NO.1 FEEDER NO.1
LUGS FOR 6-2000 MCM 1-2000 NEUT. 7500 KVA TRANS. NO.1
METERING UNIT
BUS TIE
SAME AS UNIT NO.4 7500 KVA TRANS. NO.2
SAME AS UNIT NO.1 FEEDER NO.2
SAME AS UNIT NO.1 FEEDER NO.4
SAME AS UNIT NO.1 FEEDER NO.6

1. Arrange units as shown, viewed from front. Maximum space available for entire group and operating aisle is 25 ft long, 13 ft deep and 8 ft high.
2. ACB's rated 4.16-kv, 250-mva IC, current rating as shown. Closing and tripping sources to be from 125-v d-c, battery furnished by purchaser.
3. 125-v d-c supply to enter units from below. All primary cables will enter from bottom. Provide lug for 350-mcm vcl cable for connection to ground bus in unit 1.
4. Lincoln Type ADH-2 ammeters, with instrument indicating ammeter.
5. Induction type inverse 4-15A overcurrent relays (51), with 20-80A instrument attachment.
6. Test switches to be Superior S 713 B metal cover, with glass insert.
7. D1 Lincoln Type CCW graphic watt demand meter, 2.25-kw, 120–208-v, 5 amp, 120-v synchronous motor 16-day. D2 Lincoln Type CCW graphic var demand meter, 0.75-0-1.5 120–208-v, 5 amp, 120-v synchronous motor 16-day.
8. Single shot recloser, self reset (79).

The Feverish Compressor— How To Keep From Having One

After vividly describing the case of a sadly neglected compressor, the author stresses good maintenance and protective practices which could have prevented the situation. . . . Proper lubrication, he says, is of primary importance. . . . He also gives some hints about packing adjustments as well as some advice on fighting dirt and grease

By R. A. SCHAEFER

Worthington Corp.

MECHANICAL HISTORY of one compressor is a tale of woe and despair — a story which might be true, to a greater or lesser degree, of all compressors not properly maintained. This compressor's plight was noticed when the operator discovered he could boil his morning coffee on the cylinder walls with a fair amount of success. Comparatively young and in the prime of its utilitarian life, the compressor, if able, could have told a tale to wrench the tools from the box of any mechanic in a frenzy of self-reproach.

Dirty and grimy, it huddled forgotten in a badly ventilated corner of the engine room, painfully wheezing and whistling with each clanking stroke of the piston as air escaped through and around neglected packing. The suction filter was clogged with grease and dirt, and two of its belts lay broken on the floor, where they had been thrown from the moving wheel.

Cursory examination showed the piston rod to be scored and discolored from excessive heat, and a quick glance at the level gage of the mechanical lubricator showed why. No oil!

Cylinder and piston lacerations were of such degree as to demand refinishing, and many hours would be required to remove carbon and grit baked on the valves, obstructing passages and preventing them from seating. The cylinder jackets were clogged with sediment, restricting circulation of cooling water. A greasy mass in the frame oil head distance piece pointed an inanimate finger of guilt at badly worn wiper rings. Yet, this machine was only 1 year old.

Compressors Demand Care

A few minutes observation and attention each day for this machine could have averted the subsequent major repair bill, and eliminated the crippling necessity of shutting down for overhauling purposes.

Not many compressors are treated with the disrespect and lack of concern as this one, but even though unusual the case points up the need for more care and maintenance. It should, and must be remembered, that a compressor can offer dependability and economy of operation only to the extent of care lavished on it.

Present day compressors incorporate many features, such as automatic lubrication, which combined with an inherent durability, serve to cut maintenance time to a minimum. But there is no machine which, for example, can replenish its own oil supply, and therein lies the first requisite of preventative maintenance.

Proper Lubrication Important

Lubrication being essential, operators should be made aware of damage caused by an improperly oiled air cylinder and running gear. The film of oil maintained between the piston ring and cylinder wall acts as an antifriction medium, and serves as a sealing agent to prevent air from slipping by the piston. Periodic checking of oil supply and feeder passages in the crankcase and mechanical lubricator, where provided, to forestall the possibility of running dry is a must.

Following an extended period of idleness, pump the lubricator several times before restarting to insure surfaces in contact of having sufficient oil to replace that which may have slipped from the walls during the shutdown.

Excessive oil, on the other hand, can be wasteful as well as prove to be hazardous. By vaporizing in sufficient quantities to form a combustible mixture it is capable of being ignited by heat of compression or high temperatures caused by valve leakage. Oil flashing, even if not noticeable, can be dangerous if it removes the protective oil film from the walls, paving the way for scoring.

Where manufacturer's lubrication tables are not available to serve as proper oiling guides, a general rule would be 1-2 drops of oil per min, for every 1000 sq ft of surface swept per min.

Since a great percentage of compressors are lubricated by splash-flood methods, operators should be particularly concerned about crankcase oil level. Sufficient liquid should be present to permit splashers to liberally distribute oil to moving parts. Frequently sludge deposits collect in the oil sump, caused by constant churning and eventual oxidation of oil, moisture and other sediment. The whole mass will act as a catalyst for further oxidation, requiring oil to be changed periodically, dependent on type of duty. For heavy duty lubrication protection, a paraffinic base oil is best: its greater chemical stability toward heat, and lesser viscosity change under varying temperatures being the prime factors.

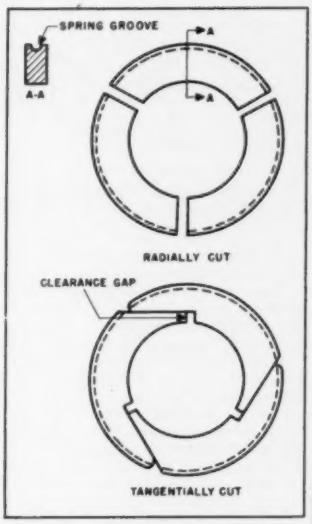


Fig. 1. Radially cut metal packing ring, top, seals tangential cut in second ring, bottom, which prevents leakage around the compressor's piston rod

Packing Subject to Abuse

Packing is probably subject to the greatest abuse, and it can be safely estimated that 4 out of every 7 compressors operating today need packing adjustments. This is all the more wondrous when you note that packing maintenance is relatively simple, and yet creates great improvement in performance. Every cu ft of air that dissipates itself in atmosphere, has its counterpart in hp wasted compressing it.

Where fibrous packing is used, install the pieces with cut ends staggered to minimize blow-by, and draw the stuffers snug. Graphite packing has high moisture absorbent qualities, and it is usually good practice to relieve stuffer nuts when the compressor is shutdown, to allow air to circulate to some extent in the gland, and to permit free oil circulation when restarting.

Metallic packing should be regularly checked and cleaned to prevent lapped surfaces from accumulating dirt and carbon. Filing segment ends

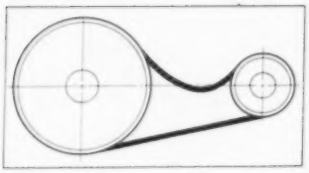


Fig. 2. Correct position of compressor V-belt before tightening. Slack should be all on one side

to readjust clearances, and changing spring lengths to correspond, will add to their life. The radially cut ring, as shown in Fig. 1, is first in the packing group and serves to seal the tangential cut in the second ring. This latter ring, also shown in Fig. 1, seals and thus prevents air leakage around the piston rod.

Replace packing when it has outlived its usefulness as a seal. Attempted postponing of the inevitable shows up in an increased rate of bhp per cu ft of air delivered.

Dirt and Compressor Troubles

Dirt is the forerunner of approximately 70 per cent of all compressor troubles. Grit and other foreign matter find their way into suction ports and provoke excessive valve and ring wear, and in some cases cause irreparable damage to the bore.

Intake filters should be dismantled and checked regularly, with clean cartridges and elements installed wherever necessary. Oil type filters should be stripped, old oil removed together with its residue, and replenished with clean oil of approximately the same viscosity as that in the cylinder lubricator.

Scraping and cleaning suction piping between filter and compressor always pays large dividends. New installations using welded pipe frequently have weld shot clinging to pipe walls, which eventually drop, and find their way into the compressor. Resultant effect is similar to firing buck shot into intake ports. Piping of this nature should be carefully scrutinized for such a condition and swabbed out wherever suspicion warrants it.

Never clean piping, or a cylinder, with gasoline or other highly volatile solvents. Their low ignition point creates a very hazardous operational state.

Cooling Water Precautions

Dirt in cooling water jackets and intercoolers can seriously impair heat removal process, causing a temperature rise. A higher gas temperature will constitute a volumetric loss in the output of the compressor. Hot cylinder walls also will cause noticeable change in the viscosity of lubricating oil, possibly reaching extremes high enough to "crack" the oil.

Compressors can be operated with the water jacket lukewarm to the touch, or about 105 to 110 F. Needless extravagance of cooling water is subsequently avoided, and a minimum of condensation occurs when hot air comes in contact with the cold jacket. Prevention of rust in this way eliminates yet another source of premature wear.

In belt connected units, care of the multiple V-belt drive is also stressed, since belt slippage reduces hp delivered to the compressor shaft. Recognize the fact that, when tightening belts, you are not loading a huge slingshot. V-belts are designed to transmit power from wedging action of the belts rather than from tension applied.

Adjusting belts unevenly leads to an unequal load distribution which shortens belt life, and causes belt "slap" when the compressor is running. Fig. 2 depicts the correct position of belts prior to tightening: the slack should all be on one side, and belts then tightened to slightly beyond the squeal point.

Unequal sheave or flywheel alignment, referred to more often as "flywheel wobble", should be avoided to circumvent eccentric bearing wear. A maximum rim run-out of 0.015 in. is usually permissible.

Protective Devices

Protective devices for your compressor are certainly worthwhile considerations in all cases. Thermostats in the discharge line to detect excessive temperatures; automatic water valves to shut off water supply to cylinder jackets during shutdown periods; bearing temperature indicators; and time delay relays for automatic initial unloading: all are items which pay for themselves by aiding in care and protection of your investment.

Precautions to be observed in any compressor operation are many, but time consumed in carrying them out is negligible when viewed in comparison to the cost of shutdowns to plant economy.

Drilling At Correct Speed Through Any Material

By F. E. RILEY

RUNNING TWIST drills at correct speed ensures long drill-point life and better quality holes. Calculating the speed correct for both material and drill diameter can take more time than necessary to drill the hole. A time-saving solution is to calculate correct speeds only once, and to compile a simple chart which will show those speeds at a glance. Correct speed shown on the chart is indicated by belt pulley step positions.

Such a chart, compiled for a ½-in. Delta sensitive drill press is illustrated in Fig. 1. Highest drill speed is 1 and other speeds are indicated by progressively larger numbers. When selecting drill speed, factors governing its choice are drill diameter and the material to be drilled. The figure at the intersection of these factors on the chart denotes belt position. For instance, drilling a ¼-in. hole in mild steel requires the belt to be placed on step 3, giving a drill speed of 1275 rpm.

Similar charts can be compiled for any drill press by using sets of tables found in engineering handbooks in combination with the actual drill spindle speeds of the machine.

Drill Diam	Plastic	Soft Metal	Soft Cast Iron	Mild Steel	Malleable Iron	Hard Cast Iron	Tool Steel	Alloy Steel
1/16	1	1	1	1	1	1	2	3
3/32	1	1	1	2	2	2	2	3
1/8	1	1	2	2	2	2	3	3
5/32	1	1	2	2	3	3	3	4
3/16	2	1	2	2	3	3	4	4
7/32	2	1	2	3	3	3	4	4
1/4	2	1	2	3	3	3	4	4
9/32	2	2	3	3	3	4	4	4
5/16	2	2	3	3	4	4	4	4
11/32	3	2	3	3	4	4	4	..
3/8	3	2	3	4	4	4	4	..
13/32	3	2	3	4	4	4	4	..
7/16	3	2	3	4	4	4	..	..
15/32	3	2	4	4	4	4	..	..
1/2	3	2	4	4	4	4	..	..

Fig. 1. Correct drill speeds for various materials indicated by belt pulley step positions for ½-in. Delta drill press: where, 1 equals 5000 rpm, 2 equals 2450 rpm, 3 equals 1275 rpm, and 4 equals 590 rpm.

Case of the Ruptured Ell

By H. B. McDERMID

ELECTRIC PLANT shut down, a large woodworking factory held its steam boilers in service for heating purposes only. The plant's 600-hp uniflow engine had been idle nearly 4 years, when a new maintenance supervisor took charge. He found the crew, acting under orders, had been running the engine 1 hr each month to keep cylinder walls and other parts thoroughly oiled and in working condition.

Lubrication runs demanded that the engine be warmed slowly and carefully and condensate drained from piping with each start. Steam entered the engine room from a boiler main connected at right angles to a distributing main in the room. The latter was hung from the wall, 10 ft above the floor, and coupled to the boiler main at one end of the engine room. Only active take-off was a heating supply main at the other end of the room.

Two engine supply lines, forming high arches, came off the distributing main near its midpoint. All connections were supplied with shut-off valves placed directly above the distributing main.

For use in warming up the engine and draining condensate from its supply line, there was a bypass valve above the supply line shut-off valve and discharged into the steam main below. This bypass served as condensate drain for the half of arched pipe above the shut-off valve, and as a warm up valve for the engine cylinder.

Same Procedure Followed

One weakness of the bypass was lack of an accurate way to determine completion of drainage before warm up. With pipes all well covered and both ends of the line closed, watching the open cylinder cocks on the engine was the only method of judging proper drainage. If cylinder cocks showed nothing but steam drainage and enough time had elapsed for condensate to drain out of the top half of the arched main, it was assumed safe to go ahead with the engine start. This procedure was always followed by the crew, who had high respect for high pressure steam and took no chances.

One more feature of the piping should be mentioned — both ends of the engine room main were connected by 8 x 3-in. reducing ells to a condensate drain line, just below the main. Kept constantly drained by traps rigorously watched and serviced, all pipe and fittings were of extra heavy duty, fit for 250 lb service.

Used for space heating only, the system had 110 lb steam pressure on it during this lubrication run. Steam would flow from the boiler main connection, through the full length of the engine room main, past the centrally located engine mains, to the opposite end of the room; and finally up through the heating main.

When the new supervisor deemed engine and line ready for this particular start, he sent a workman up a ladder to open the engine line shut-off valve. The same man who had performed the task many times before began slowly and carefully to open the valve. The supervisor stood about 6 ft from the end of the room, facing the head-high reducing ell, closely watching the man at the valve. Piping gave no distress signals — no popping or cracking that often begins when steam is turned into a cold line — and everything seemed routine.

Then It Happened

In the next instant the reducing ell ruptured, shooting a 3-in. jet of steam to the concrete floor where it mushroomed over the room. Blinding fog instantly filled the room. The supervisor was knocked to the floor and blown 10 ft along the wall to the boiler room door where he managed to catch the door jamb. Three times he attempted to regain his feet, and three times he was knocked down. Finally, he crawled into the boiler room far enough to be able to stand.

As he started back into the engine room to help the workman at the valve, he was knocked to his knees again. The workman, following the same path as the supervisor had taken along the wall, was blown through the boiler room door, crashing into the supervisor.

Neither man was injured, except for severe nervous shock and a thorough wetting. As soon as crown valves on the boilers were shut, things began returning to normal. But the mystery still remained — what had caused the rupture? Extensive study failed to find a satisfactory reason for the accident.

After replacing the broken ell, a new bypass was installed around the engine feed line shut-off valve, and a bleeder valve put in which afforded visual inspection of engine feedline contents. These precautions greatly reduced the possibility of similar accidents, but they do not explain the one accident among scores of apparently routine starts.

"Now, let's get the oil off this bolt and see what it looks like!"

Basic Power Plant FIGURING

By **WILLIAM H. ENGELMAN** Mechanical Engineer, Cleveland, Ohio

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How to Figure Air Requirements and Forced-Draft Fan Capacities for Boilers

THERE IS an easy method of figuring the theoretical required amount of air for combustion in boiler furnaces, based upon the Btu content of the fuel, and here it is.

The formula for the weight of this theoretical amount of air per one pound of fuel burned is as follows:

$W_a = 11.52\ C + 34.56(H - 0/8) + 4.32\ S$ = lb dry air per lb of fuel.

But allowing for 1 per cent moisture by weight in the air, we have:

$W_a = 11.63\ C + 34.88(H - 0/8) + 4.35\ S$ = lb air per lb fuel.

Applying this formula to various fuels, it has been found that, for 10,000 Btu in the fuel, the theoretical air requirement is about 7.65 lb. Using these constants:

$$\text{Theoretical lb of air} = \frac{\text{Btu} \times 7.65}{10{,}000} = \text{for complete combustion per lb fuel.}$$

The pounds of coal burned per hour =

$$\frac{\text{Bhp} \times 34.5 \times 970.3}{\text{Boiler efficiency} \times \text{Btu}}$$

Combining these two formulas, the theoretical weight of air per hour is

$$\frac{\text{Bhp} \times 34.5 \times 970.3 \times \text{Btu} \times 7.65}{\text{Boiler efficiency} \times \text{Btu} \times 10{,}000} = \frac{\text{Bhp} \times 25.61}{\text{Efficiency}}$$

(the Btu cancel out)

Now convert pounds of air to cubic feet, assuming the average boiler room temperature as 70 F (at which the air density is 0.075 lb per cubic foot). With this value, and converting an hour to minutes, we have:

$$\text{Theoretical cu ft air per min} = \frac{\text{Bhp} \times 25.61}{\text{Efficiency} \times 0.075 \times 60} = \frac{5.69 \times \text{Bhp}}{\text{Efficiency}}$$

(100 per cent air for perfect combustion)

Perfect combustion cannot be obtained, but complete combustion can be had when more than the exact chemical requirements of oxygen is used, which means more air than the theoretical amount or 100 per cent. This air is called "Excess Air" and is expressed in per cent. Thus, with 40 per cent excess air the total air is 140 per cent. Using the constant 1.4 for 140 per cent, we have:

$$\text{Total air in cfm} = \frac{1.4 \times 5.69 \times \text{Bhp}}{\text{Efficiency}} = \frac{7.97\ \text{Bhp}}{\text{Efficiency}}$$

For 50 per cent excess air, the constant 1.5 gives

$$\frac{8.54\ \text{Bhp}}{\text{Efficiency}}$$

These formulas are fairly accurate in determining the cubic feet of air per minute (cfm), which the forced-draft fan must supply to the boiler.

Bhp = Boiler horsepower.

One boiler hp = 34.5 lb water evaporated per hour from and at 212 F.

970.3 = Btu required to evaporate 1 lb of water at 212 F.

Efficiency = Overall efficiency of boiler in per cent, expressed as a decimal.

Btu = Heating value per pound of fuel as fired.

Air required in cubic feet per minute per Bhp, at various efficiencies and with various per cents of excess air; the CO_2 is in per cent for complete combustion

Excess Air, Per Cent	Factor for Total Air	Per Cent CO_2	Efficiency, Per Cent									
			64	66	68	70	72	74	76	78	80	82	84
			Cubic Feet of Air at 70 F per Boiler HP per Minute for Bituminous Coal										
0	1.00	18.57	8.89	8.62	8.37	8.13	7.90	7.69	7.49	7.30	7.11	6.94	6.77
10	1.10	16.84	9.78	9.48	9.20	8.94	8.69	8.46	8.24	8.03	7.82	7.63	7.45
15	1.15	16.10	10.22	9.91	9.62	9.35	9.09	8.84	8.61	8.39	8.18	7.98	7.78
20	1.20	15.42	10.67	10.35	10.04	9.75	9.48	9.23	8.98	8.75	8.53	8.33	8.13
25	1.25	14.80	11.11	10.78	10.46	10.16	9.87	9.61	9.36	9.12	8.89	8.67	8.45
30	1.30	14.20	11.56	11.21	10.88	10.57	10.27	10.00	9.73	9.48	9.25	9.02	8.81
35	1.35	13.66	12.00	11.64	11.30	10.97	10.66	10.38	10.11	9.85	9.60	9.37	9.14
40	1.40	13.16	12.45	12.07	11.71	11.38	11.06	10.77	10.48	10.21	9.96	9.71	9.48
45	1.45	12.70	12.89	12.50	12.13	11.79	11.45	11.15	10.86	10.58	10.31	10.06	9.82
50	1.50	12.28	13.33	12.93	12.55	12.19	11.85	11.53	11.23	10.94	10.67	10.41	10.16
55	1.55	11.88	13.78	13.36	12.97	12.60	12.24	11.92	11.60	11.31	11.02	10.76	10.50
60	1.60	11.49	14.22	13.79	13.39	13.00	12.64	12.30	11.98	11.67	11.38	11.10	10.84
65	1.65	11.13	14.66	14.22	13.81	13.41	13.03	12.69	12.35	12.04	11.73	11.45	11.18
70	1.70	10.80	15.11	14.66	14.22	13.82	13.43	13.07	12.73	12.40	12.09	11.80	11.51
75	1.75	10.50	15.56	15.09	14.64	14.22	13.82	13.46	13.10	12.77	12.45	12.14	11.85
80	1.80	10.20	16.00	15.52	15.06	14.63	14.22	13.84	13.48	13.13	12.80	12.49	12.19
85	1.85	9.92	16.45	15.95	15.48	15.04	14.62	14.23	13.85	13.50	13.16	12.83	12.53
90	1.90	9.65	16.89	16.38	15.90	15.44	15.01	14.61	14.22	13.86	13.51	13.18	12.87
95	1.95	9.40	17.34	16.81	16.32	15.85	15.40	15.00	14.60	14.22	13.87	13.53	13.21
100	2.00	9.16	17.78	17.24	16.74	16.26	15.80	15.38	14.97	14.59	14.22	13.88	13.55
105	2.05	8.93	18.22	17.67	17.15	16.67	16.20	15.76	15.35	14.95	14.58	14.22	13.89
110	2.10	8.72	18.67	18.10	17.57	17.07	16.59	16.15	15.72	15.32	14.94	14.57	14.22

With 70 F air and a density of 0.0750 lb per cu ft, the theoretical cubic feet of air per minute $= \frac{\text{Boiler hp} \times 25.61}{\text{Efficiency} \times 0.075 \times 60} = \frac{5.69 \times \text{Bhp}}{\text{Efficiency.}}$ (for 100% air)

Example: A 1000-hp boiler operates at 150% rating with an efficiency of 76% using 60% excess air. What is the air requirement in cfm and the per cent CO_2 for complete combustion?

Solution: $1000 \times 1.5 \times 11.98 = 17{,}970$; say 18,000 cfm. For 60% excess air, the CO_2 value in table is 11.49

PRACTICAL HINTS AND KINKS

SUPPORTING HEAVY DOORS

By T. H. LAINE

ATTACHING a caster to the outer unsupported corner of a heavy door is a simple way to prevent sagging and dragging of such doors. The

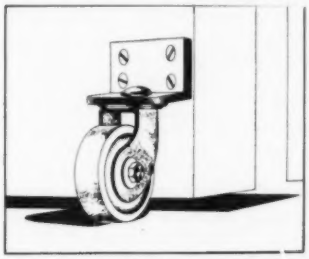


Fig. 1. Example of door supported by caster

caster should be mounted on an angle iron whose edges have been rounded to eliminate injurious sharp metal.

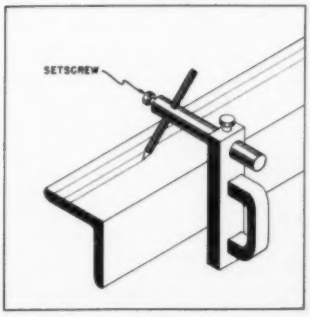
ENGINEER'S MARKING GAGE PROVES USEFUL TOOL

By F. E. RILEY

CARPENTERS have long had marking gages for scratching lines parallel to the edges of workpieces, but mechanics do not have such a useful tool within the range of standard equipment available. The ordinary surface gage is often pressed into service for scratching parallel lines, but does not prove very satisfactory principally because it is not designed for the work. In addition, normal surface gages are not sufficiently rigid to give a strong and deep scratch line.

In our maintenance shop we fabricate a lot of structures from rolled steel sections and often have to cut slots or drill lines of holes parallel with the edges of the material. I have made up a marking gage, as shown in Fig. 2, and have found it to be a most useful tool.

Fig. 2. Homemade engineer's marking gage used to scratch lines parallel to edges of metal pieces



Body, or stock, of the tool is made from a piece of cold rolled steel to which is welded or brazed a simple handle and a short piece of steel bar. A hole is drilled and reamed through the axis of the bar piece to accommodate a sliding rod. The rod can be clamped at any desired position by means of the knurled head screw. A cross hole is drilled close to the end of the sliding rod to take a drill rod scriber point.

Use of the tool is evident from the sketch, and it will be noted that lines can be scribed on work having awkwardly shaped corners. In practice, the scribing point should trail behind the stock as it is pushed along the edge of the work.

CUTTING OIL GUARD

By THOMAS TRAIL

SLINGING of cutting oil when drilling, reaming, etc., especially on small work, can be prevented by threading one end of a small diameter rod into

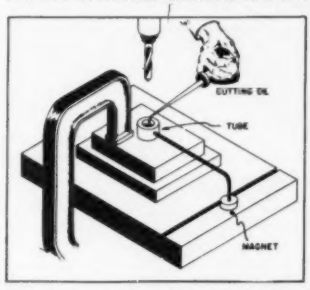


Fig. 3. Diagram showing the simple arrangement

a small permanent magnet, as shown, and brazing a short length of metal tubing to the other end. The rod of this convenient guard can be bent easily to allow tubing to be placed in any position.

REMOVING BROKEN TAPS

By W. E. WARNER

BROKEN TAPS, especially if broken off below the metal surface, are difficult to remove. An easy way to loosen them is with a magnetized piece of hard steel rod of smaller diameter than the tapped hole. Wrapped with a thin sheet of brass except at one end, as shown in Fig. 4, the rod is then mounted in an ordinary carpenter's brace.

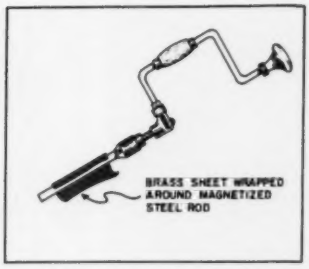


Fig. 4. Ordinary brace with steel rod inserted

Magnetism affects a strong grip on the tap which enables it to be drawn out easily. The brace enables pressure to be put on the rod, while the brass wrapping acts as a magnetic screen.

NEW USE FOR SOLDERING IRON

By H. MACK

USE OF a soldering iron in an unusual spot solved a problem of screw removal. The situation called for removal of screws holding hinges on a plant office door. Several layers of paint and an "aged in the wood" bond between the screws and the wood prevented their easy removal without risking considerable damage to paint surrounding the screw heads.

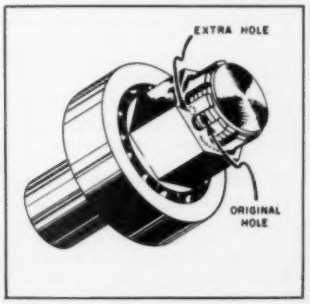
The soldering iron, heated and applied to the screw heads, warmed the screws sufficiently to break the bond of paint layers. Slight expansion resulting from the screws heating broke their tight fit in the wood; thus, when the screws had cooled and contracted, removal was readily accomplished.

CLOSER ADJUSTMENTS WITH A CASTELLATED NUT

By GEORGE STREETE

WHEN a castellated nut is used to maintain close adjustment of an operating part, such as a ball bearing, an extra hole drilled through the shaft will permit closer adjustments to be made readily. The hole should be drilled a distance circumferentially from the original hole equal to ½ the distance circumferentially between adjacent slots in the nut, as shown.

Fig. 5. Diagram showing where extra hole should be drilled in nut to permit closer adjustments



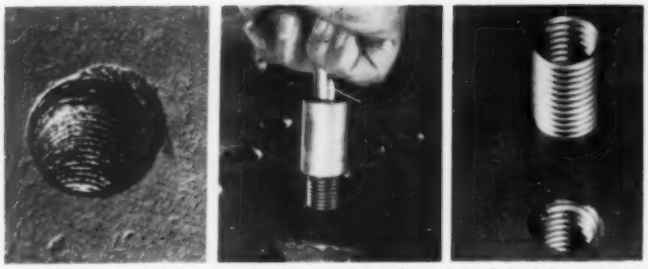


Fig. 6. After worn thread, left, is cleaned and re-tapped, thread insert is installed in hole, center, with the inserting tool. Reconditioned hole, right, has higher loading strengths than the original tapped hole

WIRE INSERTS QUICKLY REPAIR STRIPPED THREADS

STAINLESS-STEEL helical-wire thread inserts are reducing equipment downtime wherever machine operations are impaired by stripped or worn threads. Time and cost savings up to 80 per cent have been reported when comparing the wire-insert method of thread repair with conventional ones. In addition, thread-inserts provide higher loading strengths and are more resistant to wear and corrosion than original threads.

Tapped threads in all types of industrial castings — including diesel engine cylinder blocks, air conditioning fan bases, electric motor cases, pump house castings and punch-press bolster plates — may be quickly and economically restored with these inserts.

Heli-Coil thread-inserts are available in the following standard thread classifications: 4–40 to $1\frac{1}{2}$–6 sizes in National and Unified Coarse thread series; 6–40 to $1\frac{1}{2}$–12 in National and Unified Fine thread series; and $\frac{1}{8}$–27 to 1–$11\frac{1}{2}$ in the pipe thread series. They are also available in aviation and automotive spark plug series. These inserts are supplied in 1, $1\frac{1}{2}$ and 2-diam lengths. For special applications, non-standard threads and sizes can also be supplied.

In comparison with conventional thread repair operations — the oversize-thread method, the build-up by welding method, and the solid bushing method — the wire-insert operation requires only the cleaning out of the damaged thread, re-tapping of the hole with Heli-Coil taps and the placement of the wire-insert in the re-threaded hole, as shown in Fig. 1.

Because they are slightly larger than the hole into which they are installed, these thread inserts are self-locking. No amount of vibration or bolt tightening will loosen them. However, they can be quickly and easily removed with a special tool if this should become necessary.

CURVED DRILLING IN METAL

DRILLING a curved hole in metal sounds like a joke, but not to George Kemeny, Westinghouse research engineer. He developed a system that actually does that very thing, because a straight hole just couldn't be used to record internal temperatures in certain metal parts.

A curved hollow electrode having the same shape as the desired hole was devised. This electrode was jiggled against the piece to be drilled and the ensuing electric arc ate away the metal in front of it. A stream of water flowing through the hollow electrode flushed away molten metal. Result: a clean cut hole curved in the same degree as the electrode that formed it.

The new device will drill a curved hole with a radius of 1 to 4 in. One possibility for its use in industry is in improving design of engine lubricating and cooling systems.

SIMPLIFY CROSS-HATCHING

By SIDNEY V. WORTH

LINES sketched parallel to the working edges of an ordinary transparent triangle provide spacing guides

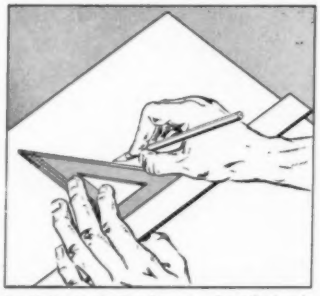


Fig. 8. Sketch showing lines on edge of triangle

for cross-hatching work. Varying the line spacing produces cross-hatch size variations as desired.

ADAPTER ADDS TO VISE USES

By F. E. RILEY

A SIMPLE vise adapter for holding metal plates by their edges can be made from angle iron, a few pieces of drill rod and a couple of bolts.

Top surface of the angle iron pieces is drilled and reamed to a tight tap fit for $\frac{1}{2}$ in. diam drill rod pegs. Holes are positioned to coincide with the outer dimensions of the work to be held in the vise. The pegs, placed in these holes, do the actual gripping. With proper fit, the pegs will be removable, and several sets of holes

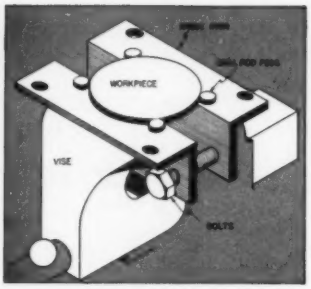


Fig. 7. Angle iron adapter fits over vise jaws to hold any desired workpiece shape in position

can be drilled to conform to any desired workpiece shape.

Two holes are drilled and tapped in one leg of the front piece of angle iron. Bolts, threaded into these holes, bear on the face of the back piece of angle iron and prevent the angles from tipping when the vise is closed to grip a plate.

Adjustable height of the pegs permits the gripping of the workpiece with no projecting pegs above the work surface.

TINNING ALUMINUM CABLES

By W. E. WARNER

A SHEATH to be tinned should first be cleaned with a scratch brush and then heated with a blow torch to a temperature sufficient to melt solder. Best solder for tinning consists of 90 per cent tin and 10 per cent zinc, applied in the form of a stick. After solder applied to the heated sheath melts, it should be scrubbed into the aluminum surface with a fine wire scratch brush.

COTTER PIN WRENCH

By FRANK J. TRAIL

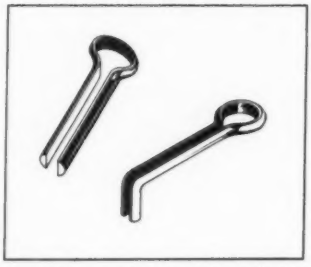


Fig. 9. Ordinary cotter pin can be used either straight or bent as an emergency spanner wrench

Correction

Putting the Finger on the Sulfur Compounds in Your Flue Gas

WE REGRET exceedingly that a decimal point slipped in one statement in this article in the April issue. On page 80, column 1, line 3, the sentence should have read: "Ash content of the oil varied from 0.055 to 0.085 per cent. . . ." and so on.

Questions and Answers

Q & A—THE POWER ENGINEER'S FORUM—

HERE'S HOW IT WORKS

YOUR QUESTION about some problem in operation, maintenance or design will be published, signed only with your initials.

Answers to your questions from other readers will be sent you as soon as received, then published as space permits, so that all may have the information.

You, too, answer questions from other engineers in the same way. You get paid well for published answers and also get the credit for knowing them.

If other engineers help you solve your problem, you express your thanks, via the Q & A editor.

Simple, isn't it. And effective! Just ask engineers who have tried it!

Question No. 498

WILL HIS PUMP LOSE SUCTION AFTER SHUTDOWN?

AS A READER who enjoys reading of others problems, may I submit a question and hope for an answer in the near future?

Recently, a pump company salesman visited the site of a plant where it is planned to charge from a reciprocating duplex to a centrifugal 1500 gpm fire pump for hydrant supply. All water will be salt water since the source is a nearby bay of tidal influence.

The plant has operated with the same suction and discharge lines since 1900. They are cast iron, and the new pump will use the same set up and piping.

The salesman stated emphatically that when the centrifugal pump shut down, which would be frequently, all salt water would run back into the bay leaving the entire suction line of about 530 ft completely dry. He stated that, in his opinion, the water column standing at the terminal drop pipe would have no effect on holding water inside the suction line.

Naturally, I feel that some water would go back into the bay because of turbulence caused by currents of pump suction being equalized after pump stops, but I do not feel that all of the water would leave the line. It is understood that no foot valve is being considered or utilized.

The question may be summarized as follows:

Would all of the water be lost from the suction pipe each shutdown and pass back into the bay, or would the submergence of 3 ft minimum in the drop line have a tendency to hold a large portion of water in the suction line? See Fig. 1.

Holding 6 gal per ft, the 530-ft suction line will require 3180 gal to fill it, and as much of that water as possible should be conserved at each shutdown. Does the density of salt water and the equalized pressure over the bay area have sufficient effect to hold in much of the water in the pipe?

California — W. M. L.

Answer No. 495

HOW CAN HE STOP DIRTY SPRAY FROM BLOW-OFF TANK VENT

IN DESIGNING boiler blow-off tanks, Reader H. T. L. must provide for discharge of nothing but clean, dry steam from tank vents. Two tanks already in use, one a modified version of the other, still spray dirty water. In improving design, can he: Separate water from flash steam discharged from vent by design of a plain tank? Build a separating device or chamber in the tank? Install an exhaust separator on the outlet end of the vent pipe? Here are some prompt and pointed solutions to H. T. L.'s problem.

Suggestions by Butcher

H. T. L. DID NOT GIVE any figures on capacity of his boilers or the amount of blowdown he wishes to handle — basic items in designing a blow-off tank. However, there are certain things which must be considered, such as amount of flash steam released; direction in which blowdown is discharged into the tank; location where blowdown enters tank; volume available in tank for released water to settle out from steam; area available for settlement to take place; and location of vent outlet.

It is necessary for the release area to be such that the velocity of the escaping steam will not exceed about 7 cfs in the upper part of the tank, with 5-psig pressure and water droplets of 0.01-in. diam. If the diameter of the droplets is increased to 0.02-in. the velocity can be increased to about 10 cfs.

The revised tank inlet pipe would tend to put water in the tank in circulation around the outside walls so it will enter the vent pipe. If the vent were in the center of the tank and provided with an enlarged entrance with a baffle below it, it should work much better. The original inlet appears better than the revised one.

No inlet pipe perforations should point upward.

Increase the diameter of the inlet pipe inside the tank materially so as to reduce the velocity of the blowdown, which must be figured on a water-steam basis as pressure is reduced.

Provide more separation space above the inlet.

Watch the velocities and pressures inside the tank at all locations.

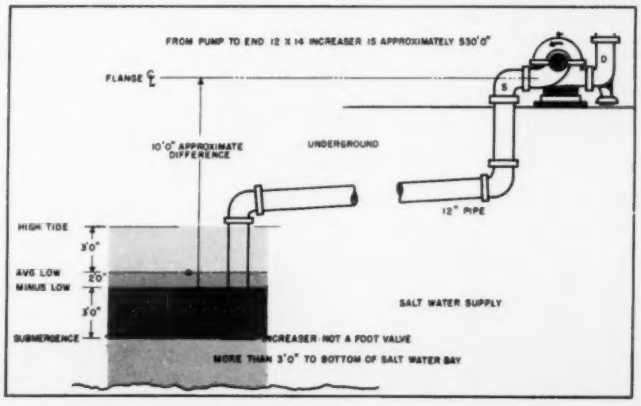
Finally, get an experienced man to check your design before building the tanks.

Cincinnati, O. — IRA A. BUTCHER

Separating Device Best

ASSUMING THAT H. T. L. has a good working knowledge of reasonable steam velocity conditions for separation of water from steam, the following suggestions may be helpful in designing the two new tanks.

Fig. 1. Will this 3 foot minimum submergence hold suction in the centrifugal pump during shutdowns?



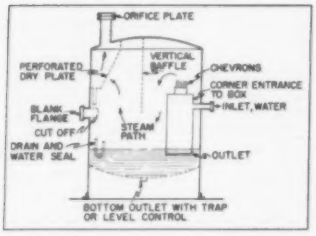


Fig. 2. Separator device built inside blow-off tank is nothing but an elementary de-steaming can

It is possible to separate water from flash steam discharged from the vent by design of a plain tank, but such a tank would be too large to be practical for most installations. It would also be possible to install an exhaust separator on the outlet end of the vent pipe, but not, in my opinion, as desirable as building a separating device inside the tank, as shown in Fig. 2.

Inside the tank the inlet pipe should be fitted with a square box extending below normal water level, but otherwise open at the bottom. Inlet blow-off water and steam mixture should enter horizontally at a corner of the box so as to realize the effect of a centrifugal separator; in other words, build a simple de-steaming can.

Top of the can could have a circular outlet in the center of the horizontal cover, surmounted by a simple assembly of chevron or tortuous-path baffles. This steam outlet should be designed to provide, normally, a modest but definite pressure drop, tending to force separated water steadily out of the bottom of the can. The entire separator should be built into one half of the tank and separated steam forced to change direction past an interior vertical baffle as shown. Finally, it should pass out through a slanted dry-plate containing smaller holes near the bottom and progressively larger holes toward the top. There should be a drain below water level on the dry side of the plate.

Outlet of the tank should contain an orifice plate in the first flange, which could be varied by the operator until an optimum size is reached for cleanest overall results. This arrangement should be capable of producing clean and substantially dry steam for discharge to the atmosphere, but it will be necessary to remove the present overflow pipe entirely and arrange for a bottom liquid outlet.

Liquid level should be controlled by a compound steam trap or by a float-type liquid level controller, preferably complete with external ball float and with a gage glass. To make these devices function, the orifice plate on the top outlet provides necessary pressure to promote continuous flow through the control valve or trap.

This method wastes a substantial amount of valuable commodities to the atmosphere. Granting there is no use for hot water from the bottom outlet and no desire to meet the expense of installing heat transfer equipment, there is likely to be valuable use for the steam. This might be true particularly in the case of H. T. L. who plans two blow-off tanks, and may very well operate them in series.

In such a case, I would advise connecting the outlet of the high-pressure, first-stage tank to conduct steam to the inlet of a feedwater heater. Some engineers, who have high and low pressure boilers, connect the outlet of the first tank to the plant steam line from the low pressure boilers; and the outlet of the second tank to the exhaust steam line of the power plant auxiliaries, using it to heat feedwater as well as to deaerate it. This would eliminate the atmospheric nuisance entirely and second stage separation could be accomplished fairly well, even with a simple open tank.

In conclusion, if my design discourages H. T. L. from the desire to design and construct his own blow-off tanks, good equipment can be purchased from numerous manufacturers.

Roxana, Ill. G. N. ANDREWS

Tips On Intake Pipe

A CENTRIFUGAL separator ought to take care of the dirt in the blow-off discharge, and at the same time dry the steam entering the vent. Several devices are marketed which could be used, but a cheaper arrangement is shown in Fig. 3.

In addition to installing the separator centrally in the tank dome, two principles should be observed in locating the intake pipe.

1. The intake pipe enters the blow-off tank horizontally near the top of the tank, discharging at a point above the bottom of the separator skirt.

Fig. 3. Centrifugal separator installed in dome of the blow-off tank should stop dirt and dry steam

2. The intake pipe strikes through the blow-off tank wall tangentially, causing the discharge of steam into the tank to circle inside the tank at high velocity before escaping through the central duct. In this way entrained mud and water in the steam are separated from the dry steam and run down the wall inside the tank.

Montreal, Canada C. W. PARKER

Brown's Solution

I OFFER as a solution to H.T.L.'s blow-off problem the following sketch, Fig. 4. As indicated, cold water condenses the flash steam and eliminates

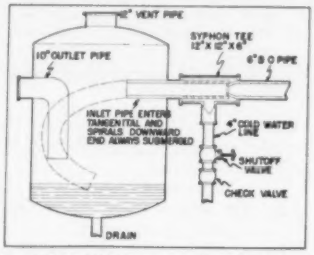


Fig. 4. Using cold water to condense flash steam

most of the violent surging caused by this action. I think it would be most difficult and complicated to separate the steam from the water. Every baffle and obstruction causes a slight increase in tank pressure which is what you wish to eliminate.

Cincinnati, O. ROY M. BROWN

Interesting Sidelight

QUESTION NO. 495 in the April issue of POWER ENGINEERING reminded me of a method I once saw used to reduce the amount of water and oil spraying from the head of a vertical exhaust pipe. Exhaust came from reciprocating steam engines, and the oil was used to lubricate the steam piston.

Method used with success in this instance was to install an old steam separator in the exhaust pipe, as shown in Fig. 5. The setting was horizontal, and on a support just outside the power house wall. The

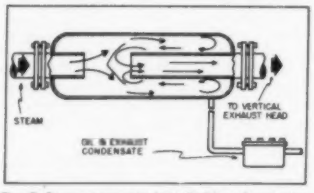
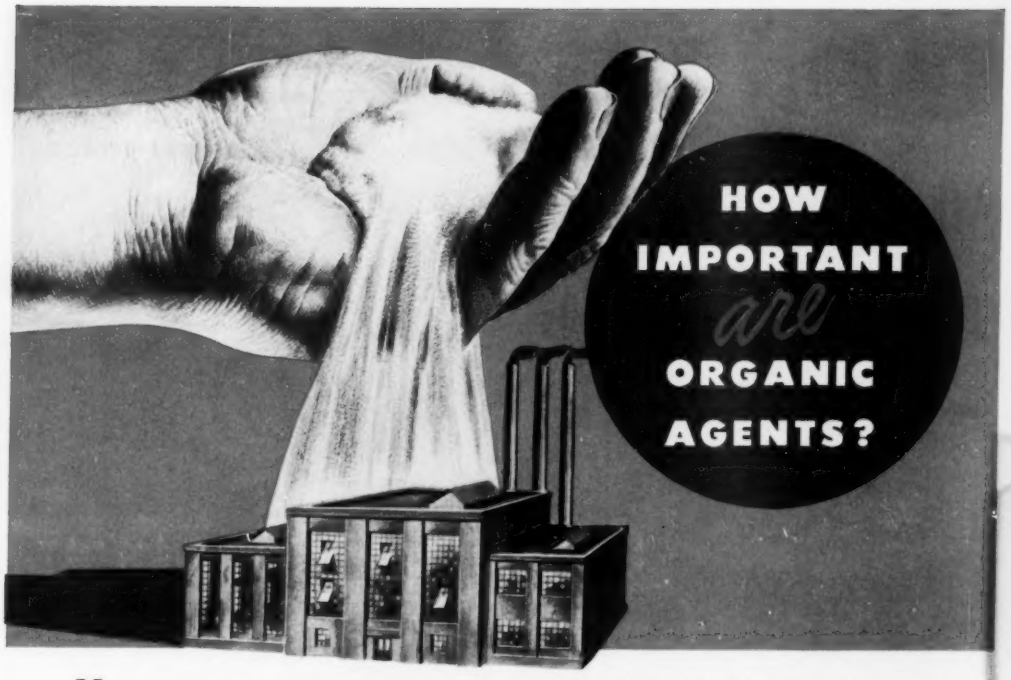


Fig. 5. Steam separator installed in exhaust pipe

steam came up from an underground exhaust chamber under the engines, entered the separator and after passage through that vessel turned upward to an exhaust head about 10 ft above the roof.

Before installing this vessel as a water and oil remover, there were complaints of oily spray sprinkling lawns, newly washed cars, and so on.

Seattle, Wash. OLIN L. BRAGE



Modern power plant practice demands a water conditioning program that produces only the ultimate in trouble-free and efficient boiler operation.

External softening and the use of conventional inorganic treatments are recognized requisites. However, the supplementary use of organic agents may well assure the difference between long, uninterrupted operation and frequent boiler outages due to scale and sludge formations.

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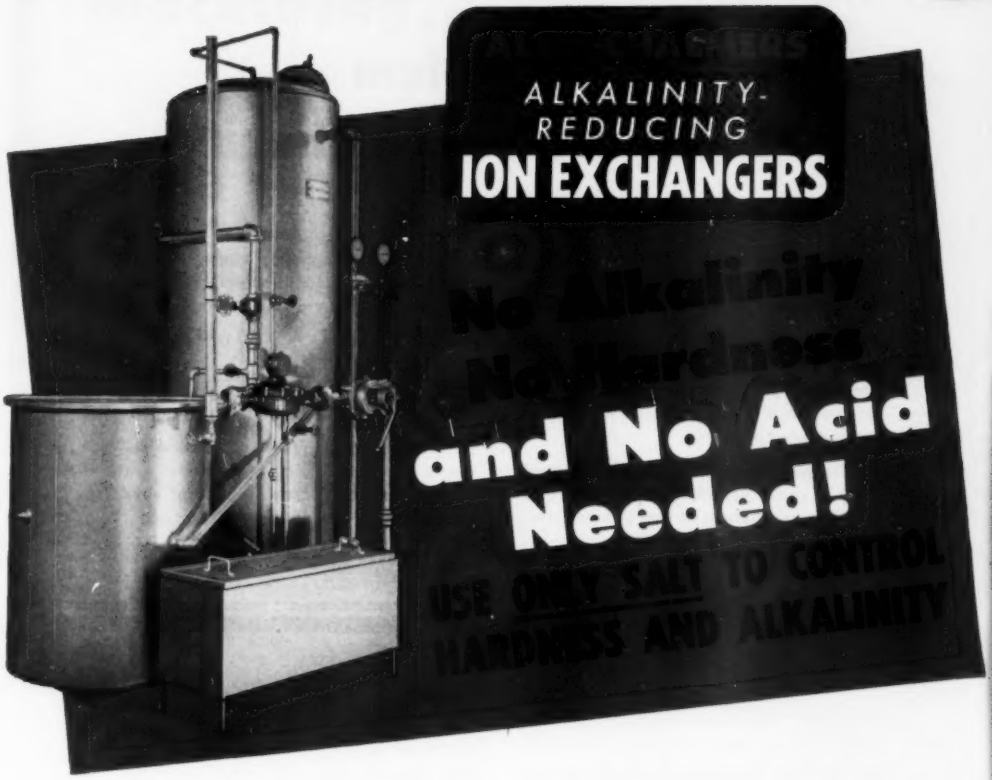

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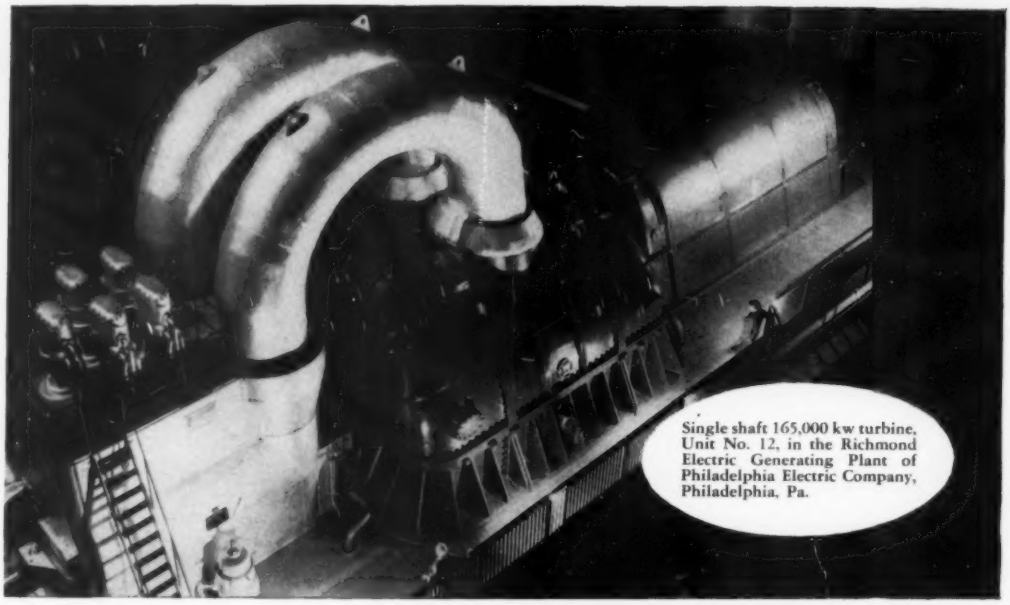

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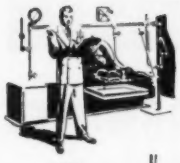

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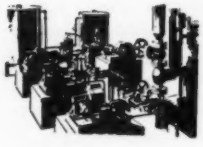
2. Studies All Available Water — Starting at the source, Bird-Archer makes exhaustive analyses of water supplies.

3. Develops Treatment and Control Systems—On the basis of these comprehensive studies, Bird-Archer develops a complete system of treatment and control, including necessary operational changes.



4. Specifies Equipment that May Be Necessary — Bird-Archer determines whether installation of additional equipment will be helpful . . . analyzes benefits to be derived.

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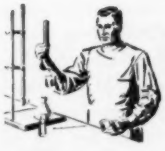

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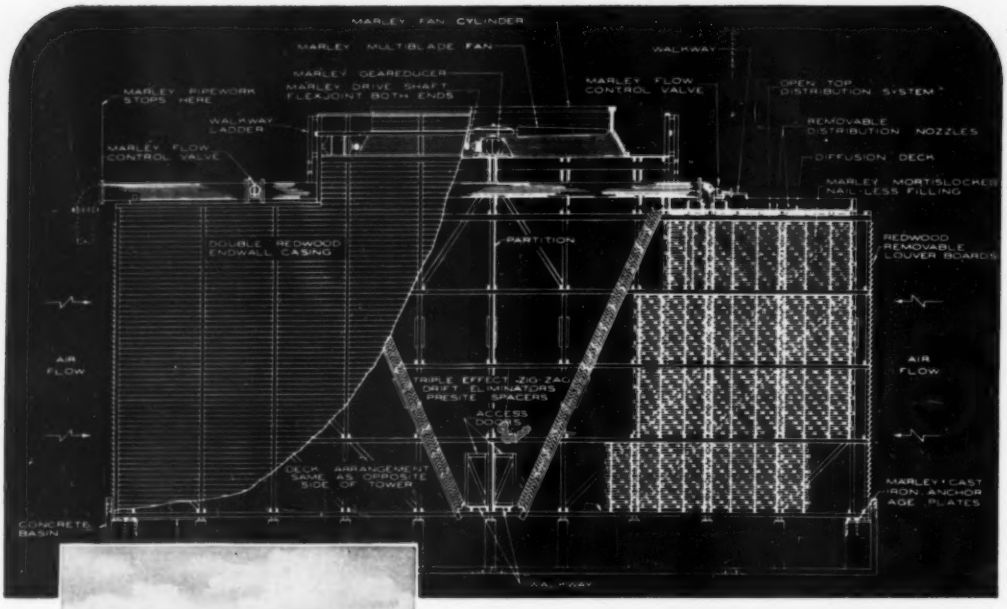

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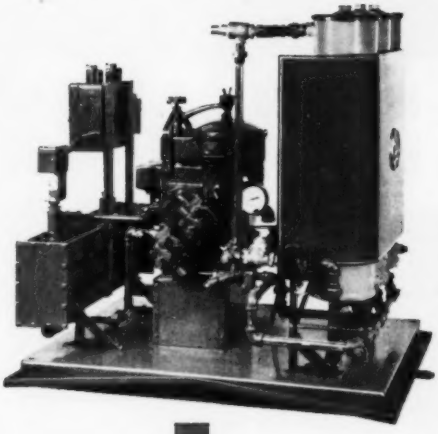

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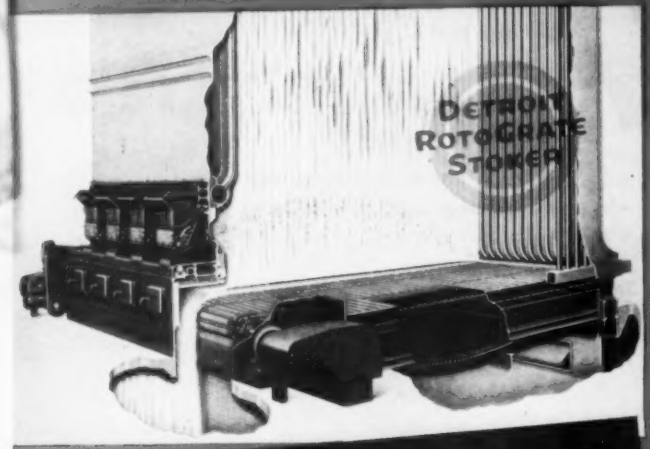

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Dow's Demineralization

(*Continued from page 82*)

mineralizing plant, then gave details of section 2.

Improved Demineralization

The second section of the demineralization plant went into operation in May 1950. This provided additional boiler feedwater capacity for the second and third 400,000-lb-per-hr boilers. Greatly-improved ion exchange resins were available at this time. A flow diagram of this section is shown in Fig. 1. Dowex 50 (Nalcite HCR) Cation exchanger is a sulfonated polystyrene resin of high capacity. Dowex 2 (Nalcite SAR) is a highly basic Anion exchanger of the polystyrene type. This resin containing quaternary amine groups removes silica directly, eliminating the necessity for fluoride feed to the cation exchanger as well as the acid salt addition step in the regeneration of the anion exchanger. Also, CO_2 is removed by Dowex 2, so the vacuum deaerator was installed between the cation and anion exchange units to remove the bulk of the CO_2 mechanically rather than by ion exchange.

This section was designed for 1500 gpm and operates very satisfactorily at 2000 gpm. On occasions it has operated up to 2200 gpm. In fact this section has exceeded expectations to the extent that it has furnished all the feedwater for the three boilers. Section 1 has not been required since section 2 went into service.

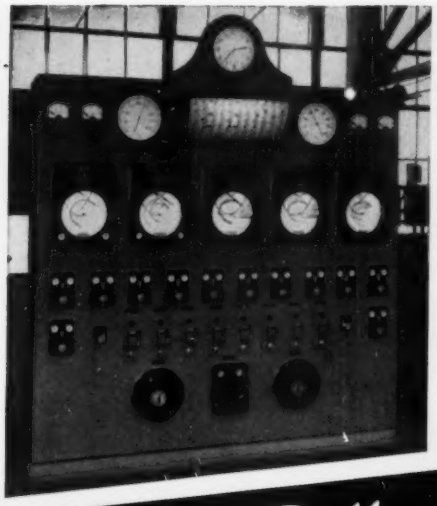
Section 2 on first operation produced only 1,000,000 gal per cycle instead of the 2,500,000 gal expected before sodium break-through. But by minor physical changes, the cation sections of section 1 were converted to pre-filters, the anticipated capacity of the cation exchangers of section 2 was obtained and their acid efficiency increased from 22 to 62 per cent.

Control of Plant

The demineralizing plant is operated by one man from a central control room. Samples are tested here also. Flows and conductivities and pH are recorded here, automatic backwash and rinse timers are provided, pilot lights indicate valve positions and a truly central control is achieved.

The author described in his paper the details of cation and anion regeneration and of the heat exchangers. All exchangers, the deaerator, valves, fittings and piping in Section 2 are Saran-Rubber-lined. All external surfaces of tanks, piping and pumps are insulated with ground cork to prevent atmospheric moisture condensation.

Unusual feature of Section 2 is the vacuum deaeration in a 15-ft diameter Saran-Rubber-lined sphere. Vapors are removed from this by steam jet ejectors. Vacuum of 0.5 in. Hg is maintained in the sphere.



This Bailey Boiler Control Panel in a mid-western industrial plant saves fuel and insures safe operation of a 100,000 lb per hr, 175 psi, sat., pulverized coal and gas-fired boiler.

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For better control-dollar efficiency—for more power per fuel dollar, less outage and safer working conditions, you owe it to yourself to investigate Bailey Controls. Ask a Bailey Engineer to arrange a visit to a nearby Bailey installation. We're proud to stand on our record: "More power to you!"

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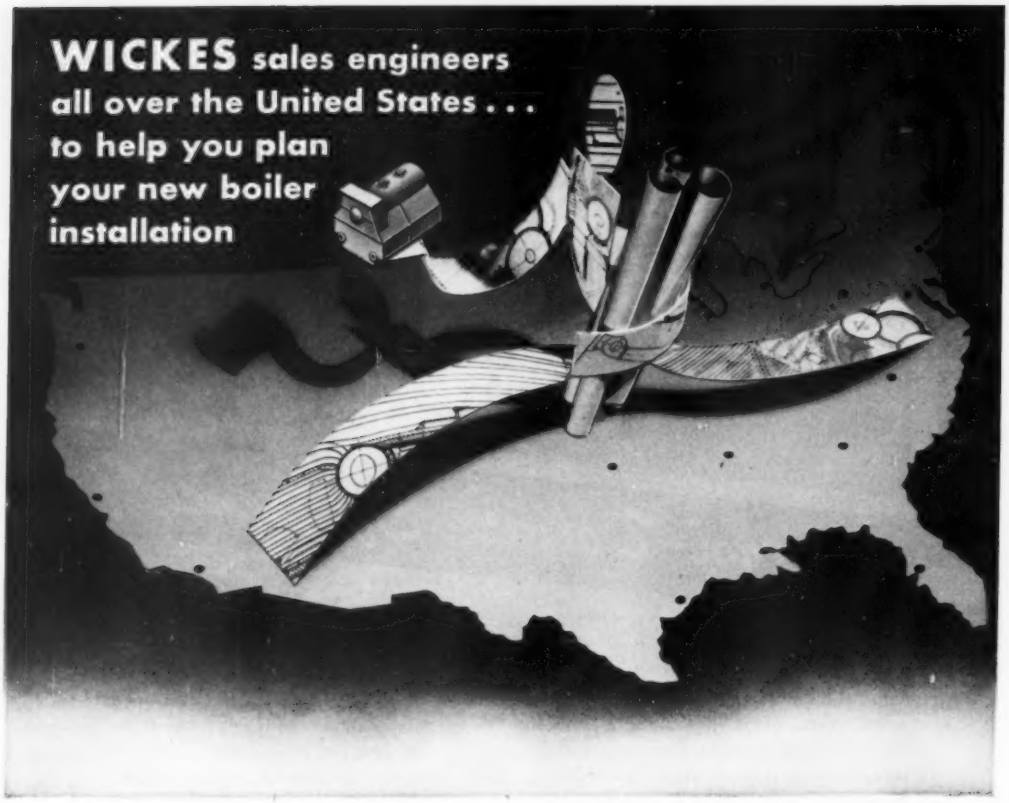
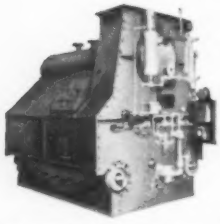


In twenty-three principal cities in the U. S. and in several industrial centers outside the country there is a Wickes sales engineer—who really knows boilers—ready to help you. This widespread sales organization, alone, helps greatly to increase the service you get from Wickes, and once you place an order for a Wickes boiler, Wickes engineers and production men get into production without delay. Wickes knows that when you want steam generating equipment, you want it. A Wickes installation is a complete installation. One contract covers all controls, all accessories, all engineering, all work from original survey to final brick-work and installation ready-to-go. ✓ ✓ ✓ Throughout the world, industries and institutions that depend on steam have learned to depend on Wickes for efficient, low cost steam power. Wickes can fill your requirements for steam generating equipment up to 250,000 lbs. per hour and 1000 psi.—all types of multiple drum boilers adaptable to any standard method of firing. Write today for complete information or consult a Wickes sales engineer.



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141

RECOGNIZED QUALITY SINCE 1854

The deaerator for section 2 is a 15-ft diameter sphere. Cation effluent is sprayed at the top and cascades over redwood packing. Vapors are removed through special baffles at the equator by 3 stage steam ejection. Tail water from the three barometric condensers is measured over a weir and pumped back into the raw water header. Non-condensables are vented through the roof from the after condenser. Level controls maintain approximately 30-in of water in deaerator. Vacuum deaeration of Cation effluent presented a corrosion problem, but "Saran Rubber" lining has been entirely satisfactory in spite of the high vacuum (an average absolute pressure of ½ in. of mercury is maintained).

Operating Results

With the atomizer in the designed condition, the operating results are well within the guaranteed limits of 2 ppm CO_2 and 0.2 ppm of dissolved oxygen. These limits were set for section 1 using weakly basic anion exchanger, and it was imperative to remove all possible CO_2 in the deaerator. These results are not nearly as critical in section 2 with highly basic anion resins following the deaerator to remove the residual CO_2.

Corrosion can be experienced in the spray valve causing improper break-up of the water resulting in an effluent concentration of 5 ppm CO_2 with no sacrifice of demineralized water quality.

The quality of the demineralized water has exceeded expectations and is superior to results obtained on a laboratory or semi-plant scale. The specific conductivity is consistently less than one micromho and will average about 0.75. CO_2 has not been detected in the finished water leaving the plant. The silica content is so extremely low that the results are always questioned. The plant has set 0.03 ppm as the cut-off and consider a cycle exhausted at that point. Analytical results have been checked by spectroscopic and infra-red analysis and the agreement is reasonable.

Costs of Demineralizing

Total demineralization cost of 17.6 cents per 1000 gal of water is given in the paper, with a tabulated breakdown of chemical costs. For regenerant only, cost is 0.88 cents per kilogram cations removed, 0.76 cents per kilogram anions removed.

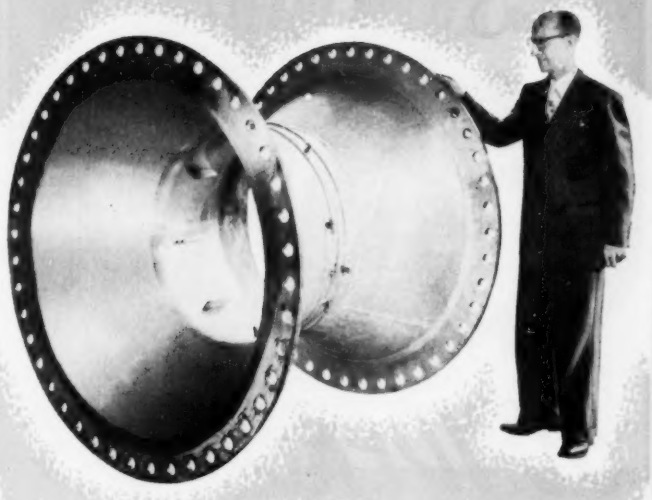
The author discussed in detail the problems of piping the demineralized water 1½ miles in a 14-in. bituminous-enamel-lined 14-in pipe to a 470,000-gal storage tank. Freezing in this tank is one problem and another was pickup of O_2 and CO_2 in discharging pure water through and into the tank.

Plans are being made to expand this demineralizing plant again to furnish feedwater for two more 400,000 lb per hr cyclone fired boilers scheduled for operation in 1953.

FOSTER FLOW TUBES

(Gentile Patents)

Are EASIER to Install



This 48" Foster Type D Flow Tube, of lightweight fabricated steel construction for measuring flow of air in the discharge line of a reactor air system, flanged for 125#, is only 48" in length between flanges and weighs only 1350 lbs.—many feet shorter and several thousand pounds lighter than a conventional venturi.

In addition to being considerably easier to handle, the Flow Tube takes up but little space, and needs no straight entering run for normal accuracy, except before and after valves in which case eight diameters are required upstream and five diameters downstream. This means that the Flow Tube can be installed without expensive vaults or housing in any readily accessible point where flow conditions are reasonably steady.

This Flow Tube, one of many for top priority defense projects, was designed to handle 29,300 SCFM at 10.12 PSIA at 238°F with a maximum head loss of 2" H_2O and with an accuracy within ±1% of the calibration curve furnished with it.

Foster Flow Tubes are made for a wide range of services metering the flow of liquids and wet or dry gases. They are available in all commercial pipe sizes, with screwed or flanged connections, bell and spigot, or welding ends, and of any materials required by the service. For further information on Flow Tubes, ask for Bulletin FT-101; and if you would like specific recommendations, please give us processing and installation details of your metering requirements.

FOSTER ENGINEERING Company

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PRESSURE REGULATORS ... RELIEF AND BACK PRESSURE VALVES ... CUSHION CHECK VALVES ... ALTITUDE VALVES ... FAN ENGINE REGULATORS ... PUMP GOVERNORS ... TEMPERATURE REGULATORS ... FLOAT AND LEVER BALANCED VALVES ... NON-RETURN VALVES ... VACUUM REGULATORS OR BREAKERS ... STRAINERS ... SIRENS ... SAFETY VALVES ... FLOW TUBES

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An extra margin of safety in high pressure gauge glass is available; extra eyes are not. Safeguard your men with SONDERGLASS, the double layer glass. SONDERGLASS is made of semi-metallic substances with different degrees of expansion. SONDERGLASS is virtually two tubes in one, the outer unaffected by cold drafts and the inner by great heat. SONDERGLASS has been tested to upwards of 1000 lbs. steam pressure and 4000 lbs. hydraulic pressure without bursting. Equip your boilers with Sonderglass, the safe glass, the glass with the extra margin of safety.

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AMERICA'S OLDEST MANUFACTURER OF MECHANICAL PACKINGS

New ENGINEERING BOOKS

Traveling Waves on Transmission Systems, by L. V. Bewley. Second Edition; 543 pages; 6 by 9 in.; illustrated; cloth; published by John Wiley & Sons, Inc., 440 Fourth Ave., New York, N. Y.; 1951. Price $12.00.

This book presents in compact and usable form the modern theories of transient surge phenomena on electric power lines and in transformer windings. These theories reduce the design of lightning proof transmission lines to a routine procedure, and provide a basis for the most economical choice of protective features required for any desired degree of operating reliability.

This second edition of this valuable book has been enlarged by over half, so as to include the many new developments in the field since the publication of the first edition. The volume is divided into two main parts: Part I (up to page 412) is devoted to the origin, characteristics and behavior of electric waves; Part II (pages 413 to 537) considers high-frequency oscillations and terminal transients of transformers.

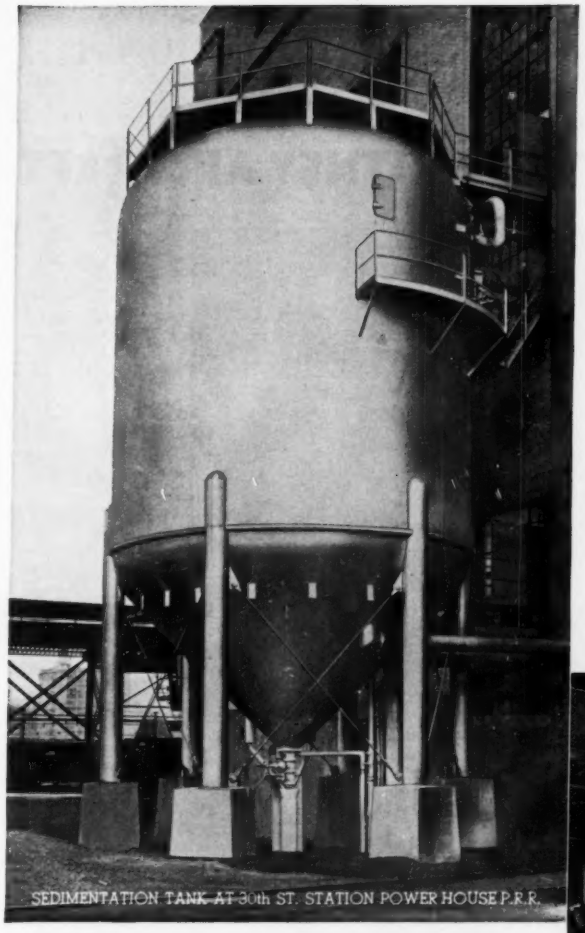
Professor Bewley is at present Professor and Director of Curriculum in Electrical Engineering at Lehigh University.

North American Combustion Handbook; 322 pages; illustrated; size 6 by 9 in.; hard binding; published by North American Manufacturing Co., 4455 East 71st Street, Cleveland 5, O.; price $2.00 plus postage.

Subject matter of the handbook, with an eye toward collecting enough information under one cover to permit easy computation of combustion problems, consists of four sections. Treated are a basic explanation of the theory of combustion; outlines for combustion, heat transfer and fluid flow calculations; charts and data to simplify and speed these calculations; and, a discussion of combustion equipment, its selection and use.

As a text, the handbook makes suitable enough allowance for the neophyte to serve with some degree of success as a primer. The beginner's discussion of combustion is intentionally very elementary, and is an essential often overlooked in promoting more enthusiasm toward detailed discussions of practical aspects and theory of combustion. Complete discussions of fuels, combustion analysis, heat transfer, flow of fluids, burner equipment, combustion control and equipment follow.

Water Treatment for Industrial and Other Uses; by Eskell Nordell; 526 pages; illustrated; size 6 by 9 in.; cloth



SEDIMENTATION TANK AT 30th ST. STATION POWER HOUSE P.R.R.

COCHRANE

Hot Process SOFTENER

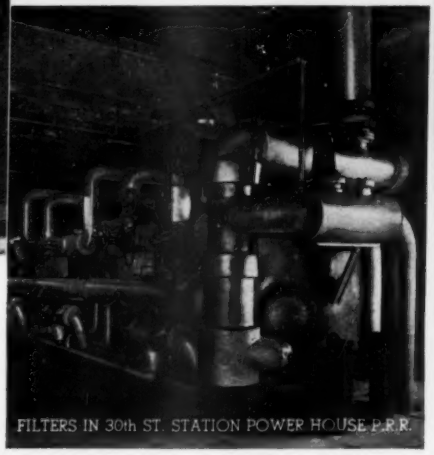
Serves a Great Railroad

ONE of the features of the huge Pennsylvania Station — 30th Street, Philadelphia, of the Pennsylvania Railroad is the ultra modern power plant, designed by internationally recognized architects and engineers.

Recently installed in this power plant to serve additional capacity is a Cochrane Hot Process Softener for the boiler feed. It will handle 80,000 gallons per hour makeup and 10,000 gallons per hour condensate.

Cochrane pioneered the development of the hot process for softening boiler feed, and has continued to lead in the field of water conditioning ever since. In recent years, Cochrane has made many installations of the new Hot Process Zeolite Softener, wherein external second stage of softening is accomplished by means of ion exchange.

Consult Cochrane on any water conditioning problem.



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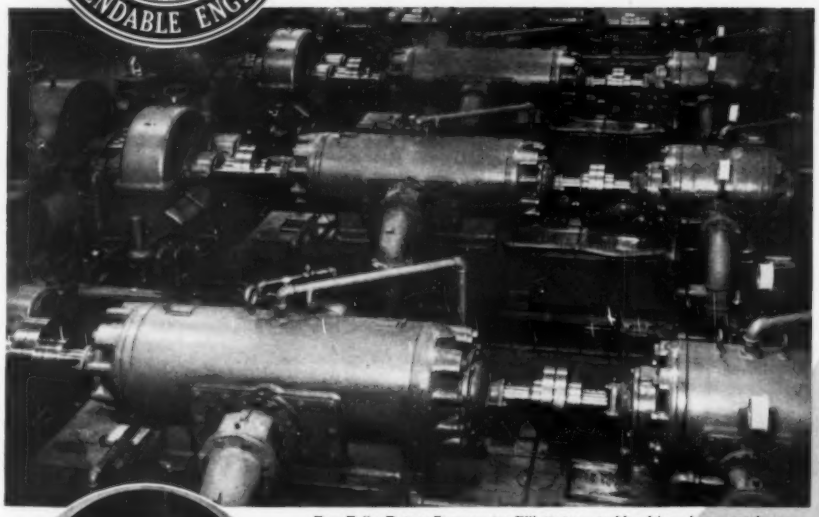
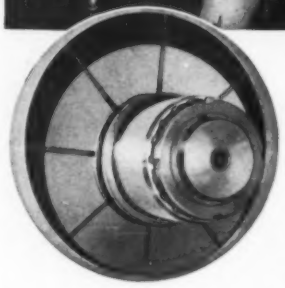
PIONEERS AND LEADERS IN BOILER FEED PROCESS & INDUSTRIAL WATER CONDITIONING

PRATT & WHITNEY AIRCRAFT



Four Fuller Rotary Compressors, Elliott steam-turbine driven, have a total capacity of 6760 c.f.m., at 110 p.s.i.



depends on FULLER AIRPOWER

Four Fuller Rotary Two-stage Compressors put Pratt & Whitney Aircraft's engine plant in East Hartford on a 100 p.s.i. air diet for such operations as shot peening, spray booths, air cleaning, and air-operated chucks.

Pratt & Whitney Aircraft has joined no *small* family of users; food and chemical plants, steel mills and cement mills, gas-gathering plants, refineries, automobile plants, foundries and machine shops, public utilities, and many others depend on Fuller for compressor equipment, wherever air is required.

Whether *your* air-plans call for single-stage, two-stage — single-stage duplex or two-stage duplex—you can be sure Fuller has the compressors which gives you a dependable source of pulsation-free air up to 3300 c.f.m., 125 p.s.i., with maintained capacity for the life of the machine.

Write for Bulletin C-6, Fuller Rotary Compressors.

FULLER COMPANY, Catasauqua, Pa.
Chicago 3—120 So. LaSalle St.
San Francisco 4—420 Chancery Bldg.

Fuller

PIONEERS OF HIGH-EFFICIENCY VANE-TYPE ROTARY COMPRESSORS

C-225
1624

binding; published by Reinhold Publishing Corp., 330 West 42nd Street, New York 18, N. Y.; price $12.00.

Assisted by 162 tables and a profusion of illustrations, the text sets down practical and up-to-date information about: impurities in water and their reduction or elimination; water requirements and treatment, in addition to current practices, for industry; and a discussion of different processes and equipment used in conditioning water.

Considerable detail is employed to explain the various water conditioning processes and their application. Individual chapters explore the Zeolite, hydrogen-cation exchanger, demineralization and distillation, cold-lime soda and hot-lime soda processes — plus a chapter on silica removal.

Well suited as a "one-stop" reference on water treatment, the book should prove of more than general interest to those with water problems.

Report on Oil and Gas Engine Power Costs For 1950; 44 pages; illustrated; size 8½ by 11 in.; paper binding; published by American Society of Mechanical Engineers, 29 West 39th Street, New York 18, N. Y.; price $2.50.

Twelfth report of a series, the ASME Subcommittee on Oil and Gas Engine Power costs analyzes 146 oil and gas engine generating plants, containing 536 engines, totaling 560,132 rated bhp, and with a net output of 899,044,521 kwhr.

Fact-finding only, the report does not attempt interpretation. Instead, information is presented with the use of charts and extensive tables on performance and production costs.

For the first time fuel economies of engines and plants are reported on the basis of Btu per gross kwhr. Formulas defining other costs, outputs and economies are similar to those used in previous reports.

Electrical Engineering, by Clarence V. Christie. Sixth Edition; 670 pages; 6½ by 9¼ in.; cloth; illustrated; published by McGraw-Hill Book Co., 330 W. 42nd St., New York, N. Y.; 1952. Price $7.00.

This splendid book on the theory and characteristics of electrical circuits and machinery presents the subject from the standpoint of the fundamental principles of electrostatics and electromagnetics. It is intended as a foundation for lecture courses for junior and senior students in Electrical Engineering. Written primarily for students in the low frequency power and industrial electrical fields it nonetheless presents an adequate basis for those particularly interested in the fields of electronic control and communication engineering.

The author is a consulting engineer in Montreal, Canada, and is Professor of Electrical Engineering at McGill University. The volume has a good Table of Contents and a comprehensive index.

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are Elected by Acclamation!

"PLANK" NO. 1
Darts are precision-ground to a perfect sphere. The true ball joint gives a drop-tight fit quickly, easily without excessive wrenching.

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Dart seats are bronze-to-bronze for maximum resistance to pitting and corrosion.

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Dart threads are full and clean-cut, unlike threads of softer metal they won't deform or strip.

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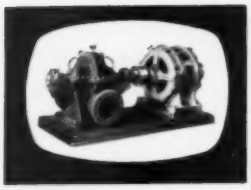
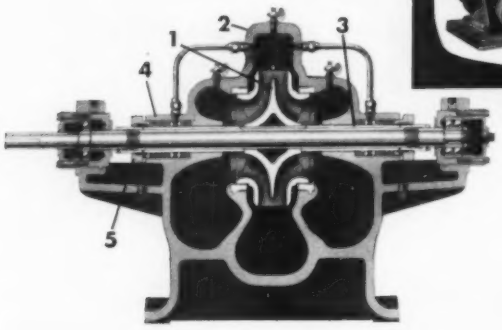
DART UNIONS

GOULDS Fig. 3450—Single-stage centrifugal pump; Capacities up to 15,000 G.P.M. Heads up to 500 ft.





These **5** *features mean*

HIGH PUMPING EFFICIENCY
LOW MAINTENANCE COST
LONG SERVICE LIFE

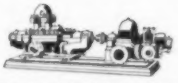
Whenever you need a pump for *general water supply, in-plant circulation of liquids, booster service or low pressure boiler feeding,* check the economy features these sturdy Goulds single-stage centrifugal pumps offer.

1. **HYDRAULICALLY BALANCED IMPELLERS** assure freedom from vibration.
2. **HORIZONTALLY SPLIT CASING,** matched and dowelled, makes access to working parts easy. All water passages exceptionally smooth due to careful core making.
3. **HEAVY BRONZE SHAFT SLEEVE** ground to smooth finish reduces friction. Saves power. Reduces wear on packing.
4. **DEEP STUFFING BOX** and bronze water seal ring minimize chance of leakage.
5. **GLAND HORIZONTALLY SPLIT AND BOLTED** to make repacking easy.

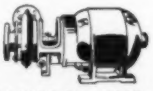
These pumps are available in all-iron or all-bronze construction, as well as standard bronze fitted. Maximum interchangeability of parts keeps inventories at a minimum. For complete details and specifications send for Bulletin 721.2.

Other GOULDS PUMPS for power and plant services

GOULDS Fig. 3047—Vertical sump pump with nonclogging impeller for water containing solids or fibrous materials. Bulletin 726.1.



GOULDS Fig. 3360—High pressure multistage centrifugal. Capacities to 2250 G.P.M. Heads to 3050 ft. Bulletin 722.5.



GOULDS Fig. 3650—"Close-coupld" single-stage centrifugal for general industrial use. Capacities to 2000 G.P.M. Heads to 400 ft. Bulletin 710.1.

MEMBER

Goulds PUMPS INC.
Seneca Falls
New York

Obituaries

FORREST NAGLER

Forrest Nagler, who retired March 1 as manager and chief engineer of Allis-Chalmers atomic power section, died April 1 in a Lake Forest, Ill., hospital. He was 66 years old.

Nagler, who held many patents in the hydraulic turbine field, joined Allis-Chalmers Mfg. Co., in June, 1906. He was graduated that year as a mechanical engineer from the University of Michigan, where he specialized in hydraulic and marine engineering. He entered the company's hydraulic department in 1908 and became assistant manager of the department in 1920.

At the end of 1929, Nagler resigned to join the A. O. Smith Corp., Milwaukee, where he remained until 1932. On January 1, 1933, he became chief engineer of Canadian Allis-Chalmers, Ltd., Toronto.

Nagler returned to Allis-Chalmers in Milwaukee in March, 1942, as chief mechanical engineer of the engineering development division. He was named to the atomic power section post in June, 1949.

Nagler was inventor of a type of axial-flow high-speed hydraulic turbine runner which bears his name. He had been a member of the ASME since 1918. He was awarded a life membership in 1921 and was made a fellow in 1951.

Nagler's other affiliations included the ASCE, the Milwaukee Engineers' Society and the Wisconsin Society of Professional Engineers.

ERIC PLAGWIT

Eric Plagwit, 76, recognized throughout the country as the dean of chimney engineers, died recently in a fall from the eighth floor of the Ruskin Apartments in Pittsburgh, Pa., during the excitement of a 6-alarm fire. He was packed and ready to leave for Berlin, Germany, to visit his brother.

Mr. Plagwit had been active in the engineering field for nearly 54 years, and had been head of the Chimney Division of The Rust Engineering Co. since 1924.

Mr. Plagwit was a member of the ASME and of the American Concrete Institute.

L. W. CHUBB

Dr. Lewis Warrington Chubb, age 69, director emeritus of the Westinghouse Research Laboratories and nationally known leader in the field of science, died April 2 at his home.

A veteran of more than 42 years active service with the Westinghouse Electric Corp., Dr. Chubb served as director of research from 1930 until September 1, 1948, when he retired.

—it **pays** to be accurate!

WHETHER slicing apples, or slicing fuel costs in the boiler room, lack of accuracy means a loss. If the combustion control system in your boiler room is not precisely accurate, you lose—and the loss that goes up in smoke can be more than you'd think.

Look at it this way. A medium sized boiler could use $10,000,000 worth of fuel in its normal operating life.

Now—if your combustion control system is not *dependably* accurate, that system would ultimately cost you five, six, or seven times its initial cost!

From this point of view, you cannot afford to buy anything less than the best—anything less than a Hagan Combustion Control System.

Our engineers will be glad to discuss what the Hagan Combustion Control System can do for you.

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HAGAN BUILDING, PITTSBURGH 30, PA.

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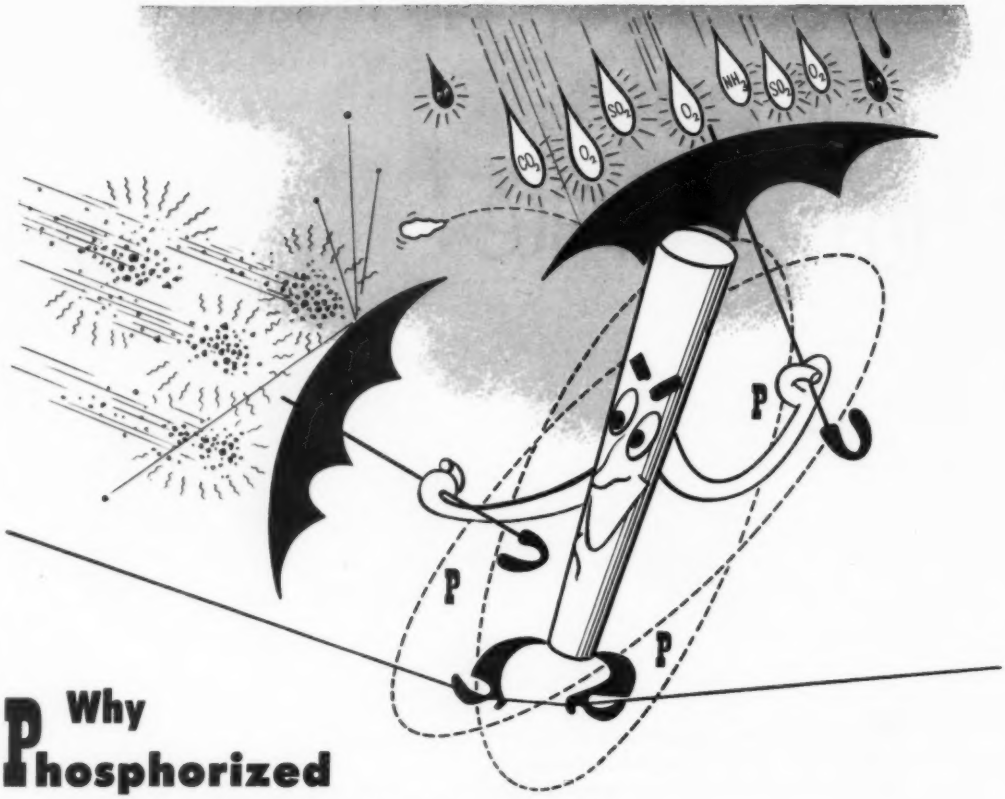
RING BALANCE FLOW AND PRESSURE INSTRUMENTS
METALLURGICAL FURNACE CONTROL SYSTEMS
THRUSTORQ FORCE MEASURING DEVICES



Why Phosphorized Admiralty Condenser Tubes?

High Resistance to Steam and Condensate

In order to assure *uniform* chemical composition and inherent *soundness*, Scovill produces Phosphorized Admiralty tubes by its continuous billet-casting process which consistently maintains the optimum amount of phosphorus. Adding as little as 0.02% phosphorus to Admiralty also gives maximum resistance to dezincification while retaining all the other desirable properties of this alloy.

Scovill's 40-page Condenser Tube Booklet is available to users who request it on their business letterhead. Scovill Manufacturing Company, 15 Mill Street, Waterbury 20, Connecticut.

Only Scovill Phosphorized Admiralty Has All These Advantages . . .

- Uniformity and soundness resulting from Scovill continuous-casting techniques
- Relative immunity to dezincification
- High resistance to steam and condensate
- Excellent performance in fresh, salt or brackish waters
- Required heat transfer characteristics
- Superior resistance to general corrosion
- Good resistance to velocities under 7 fps

SCOVILL

A PRODUCT OF SCOVILL

SCOVILL CONDENSER TUBES

"You can't buy better brass"

HELPFUL BULLETINS

(*Continued from page 38*)

can be inspected. Air circulation and details of mounting collector for various types of disposal are illustrated. Pangborn Corp.

146 High Temp Filter Bags — How company's silicone-impregnated glass fabric is being used to provide economical bag-house dust collection at temperatures to 550 F is explained in Bulletin MC-2. Discusses low cost, heat and corrosion resistance of filter bags made of this fabric, also other advantages. Also provides information on another filter bag fabric for medium temperature bag-house installations. Menardi & Co.

AIR CONDITIONING, COOLING

147 Packaged Cooling Towers — Cotuspray Bulletin 5.8.083 describes a line of low-cost packaged redwood cooling towers. Contains data and charts to aid in selection of correct model of these prefabricated towers. Models are atmospheric type. Equipment Division, J. F. Pritchard & Co.

148 Self-Contained Air Conditioners —Packaged air conditioning units in 15- and 20-ton capacities are described and pictured in Bulletin S362-A. Stresses water-saving advantage, greater cooling efficiency of these units. Tells how they operate; gives dimensions. The Trane Co.

GENERAL MAINTENANCE

150 Concrete Floors — "Traffic Concrete — A Study in Specializatioa," is a 20-pp, well-illustrated booklet explaining advantages of company's Dynapakt concrete floors in terms of materials used and especially developed methods of installation. A step-by-step comparison of these low-water methods, as opposed to other methods, is included. Flash-Stone Co., Inc.

151 Industrial Coatings — This bulletin describing a dozen special coatings for plant maintenance, covers their use in solving such problems as skidproofing, rust prevention, painting over damp areas, weatherproofing and decoration of exterior masonry, interior waterproofing, painting over hot surfaces, protection against acids and chemical fumes. Brief suggestions on the solution of each type of problem are provided. United Laboratories, Inc.

152 Roof Protection — This folder describes Halcoloid, a specially processed weatherproof asphalt for waterproofing and preserving new and old roofs. Three formulations are presented, along with application suggestions and covering capacities. The Hallemite Mfg. Co.

OTHER EQUIPMENT

153 Steam Generator Test Data — Sixteen-pp Bulletin 533, Revision A, presents tabulated data covering performance tests made on two of company's steam generators to determine their efficiency at various stages. These generators are designed to heat processing steam and sold to produce 2700 and 4500 lb of steam per hour, respectively. Test results given show both models capable of producing substantially more than rated capacities. Illustrated by photos, charts. Vapor Heating Corp.

154 Spreader Stokers — Dumping-grate and traveling-grate spreader stokers are described as to design and performance and illustrated in color in 16-pp Bulletin SB-42. Typical applications of both types are presented and specifications included. Also discussed are feeder assembly and hydraulic power drive unit of company's Travagrate stokers. Erie City Iron Works.

155 Boiler Design Trends — Results of a survey on boiler design trends in the pulp and paper industry of the South are presented in 10-pp Industrial Bulletin 2. Illustrated with tabular matter, this interesting discussion covers trends in fuel-firing

For Safer, Surer Supervision of boiler water levels--
Reliance Water Columns and Complete Gage Equipment
Forged steel strength far exceeding code requirements—Reliance Columns for pressures to 2000 lbs.; with alarms, to 900 lbs.
Precision-made gage inserts for all pressures. (Mica-protected flat glass or all-mica windows.) Sizes for all visibility lengths.
Latest developments in gage valves, gage cocks, gage illumination; auxiliary alarm devices. Write for full information.
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The name that introduced safety water columns....in 1884
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BOILER SAFETY DEVICES

ROTOJET®

Junior TUBE CLEANERS for SMALL TUBES

The new Rotojet Junior Tube Cleaner has unusual power to clean small tubes quickly. This convenient, compact, self-contained cleaner, designed for one-man operation, needs very little headroom. Tube bundles can be cleaned without removal from shell.

Roto expanding heads and brushes with replaceable wearing elements save money and assure thorough cleaning of straight and curved tubes.

Send for Bulletin J-410 for full details.

S328 ROTOJET Junior Water-driven Motor, flexible coupling, and expanding scraper

C434 ROTOJET Junior Air-driven Motor, flexible coupling, expanding brush.

S32 ROTOJET Junior Air-driven Motor, cone cutter, universal joint.

ELLIOTT COMPANY-ROTO DIVISION

147 Sussex Avenue, Newark 1, N. J.

equipment and fuels used and presents information on boilers burning pulverized fuel, stoker coals, oil, natural gas and bark, as well as black-liquor recovery boilers. Appalachian Coals, Inc.

156 What's a Silicone? — Non-technical, but one of the most informative, attractive and interesting publications on silicones, this 36-pp booklet discusses silicones from the standpoint of what they can do, how they act and why they offer so much to modern living. Clearly illustrated, text covers silicone polishes, water repellents, fluids, lubricants, release agents, defoamers, coatings, electric insulation, and Silastic, the silicone rubber. Dow Corning Corp.

157 For Extreme Bearing Pressure — Bulletin 53 presents technical data on two molybdenum-disulfide lubricants, Molykote Z, a dry lubricant in powder form, and Molykote G, a grease consistency mixture. Explains how Molykote lubricants are able to lubricate at high bearing temperatures, resist galling, seizing. Discusses application of dry and grease types. Alpha Corp.

158 For Feeding Dry Materials — Bulletin 30H-12 describes loss-in-weight gravimetric feeders, discussing operation, feeding range, vibratory feeding mechanism, synchronous motor feed rate control, hopper and accessories. Stresses accuracy of the feeders, other advantages. Omega Machine Co.

159 Automatic Fire Extinguishers — This folder introduces company's new plastic Safety Spray automatic fire extinguisher, a ceiling type unit described as fire resistant, dust- and corrosion-proof. Shows how it operates. Red Comet, Inc.

160 Fan and Blower Data — This recently issued catalog includes ordering information, prices and engineering data covering 30 fan types in over 300 sizes. Provides complete specifications, dimensions, installation diagrams and photos, as well as extensive information on how to select and install fans for industrial requirements. Chelsea Fan & Blower Co., Inc.

162 Labeling Tape — Form 6 describes a stick-on labeling tape that can be written on, or typed on. The tape has a carbon-writing surface between layers of acetate, and folder explains how it won't smudge or turn yellow. Pictures some of its uses, lists others. Includes a small sample. Labelon Tape Co.

163 Water, Waste Water Systems — An engineering and construction service for greater efficiency in sewer systems and water systems is described in this bulletin. Discusses facilities for surveying requirements, testing, designing and construction, also supplementary facilities. Pittsburgh Pipe Cleaner Co.

164 How to Choose a Furnace — Booklet B-5459, 38 pp, tells how to match a furnace to a particular heat-treating problem. Titled, "Harnessing Heat," it describes 12 types of gas and electric furnaces, briefly outlining their chief field of application; also discusses tailor made furnaces to meet specific problems. A protective atmosphere section describes four basic types available — Endogas, Exogas, Monogas and Ammogas — and gives combinations and applications of these types as well as accessories. Westinghouse Electric Corp.

Centrifugal Pump Films — Now available for use by power engineers are three 35 mm sound filmstrips on centrifugal pumps, each with a running time of about 30 min. The films are titled, "How and Why of Centrifugal Pumps," "Pump Maintenance," and "Covering All Angles." The last named describes the selection of pump and tells how to figure its installation. These films are part of a new educational service to industry. For information about showings, contact the nearest district office of manufacturer's general machinery division. Allis-Chalmers Mfg. Co.

HELPFUL BULLETINS

CATALOG LIBRARY

EQUIPMENT NEWS

ADVERTISERS' INDEX

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Power Engineering

. . . through REGULAR MONTHLY FEATURES helps you with your power engineering problems. . . . TWO POSTAGE-FREE CARDS are provided for you

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HELPFUL BULLETINS (starts on page 37) reviews for you recently published catalogs and bulletins. List item numbers of those you want on the post cards. You'll receive the literature from manufacturers at no cost to you

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3. Keeps you posted on new products—

EQUIPMENT NEWS (starts on page 60) describes new developments in power equipment. Use post cards for listing numbers of products you want to know more about

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ADVERTISERS' INDEX (starts on page 142) helps you find advertised products quickly. Use the post cards to ask for free literature advertised, further product information, or the names and addresses of distributors in your locality

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SPECIAL SERVICE is as close to you as the post cards. Use these cards to ask for tear sheets of POWER ENGINEERING articles . . . manufacturers' names and addresses . . . help with a baffling problem . . . to notify us of a change of address . . . or comment on an article

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If you prefer delivery at your home, give it here
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June 1962
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Please have the manufacturer send me, without charge, the literature or bulletins indicated by the following numbers:

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EQUIPMENT NEWS

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POWER ENGINEERING
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Your Name.....

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(If you prefer delivery at your home also fill below)

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Please have the manufacturers send me without obligation the information or bulletins indicated by the following numbers.

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Catalog Library

THIS MONTHLY list of standard catalogs and bulletins is published to help power engineers maintain a permanent catalog file of engineering data. The items listed, unlike those under Helpful Bulletins, may appear each month except for additions and deletions determined by space requirements or by the manufacturers issuing the bulletins. Use the postage-free cards on page at left for your request

VALVES, TRAPS, PIPING AND ACCESSORIES

201 Check Valves — Twenty-pp Catalog 30 presents company's line of tilting-disc check valves made in iron, bronze and steel for working pressures to 3000 psi. Explains operating principle of tilting disc construction, discusses closing without slam, reduced loss of head, other advantages. Includes construction details. The Chapman Valve Mfg. Co. *(See ad on inside back cover for more information on steel valves.)*

202 Valve Specialties — Included in 90-pp Catalog A-50 is complete ordering and engineering information on automatic pressure flow and liquid level controls for steam, air, gas, water, oil, other fluids. Sections are devoted to pressure regulators, altitude valve, pump governors and strainers; lever, float and motor operated valves; pilot valves; back pressure, relief and non-return valves, steam trap and air vent; liquid level controllers; solenoid valves. Davis Regulator Co. *(See ad on page 136.)*

203 Pressure Reducing Valves — Selection and engineering data on pressure reducing valves, including those for remote control of reduced steam or water pressures, are in 12-pp Bulletin 477-A. Northern Equipment Co. *(See ad on page 51.)*

204 Safety Valve Engineering Data — How company's safety valve works and its operating advantages are explained in Bulletin 707. Includes dimensions on valve types, tables on superheat correction factor. Manning, Maxwell & Moore, Inc. *(See ad on page 18 for information on flow control valves.)*

205 Popular Steel Valves — Condensed Catalog 104, 28 pp, describes and illustrates most widely used of company's cast and forged steel valves and the data presented for these valves is complete. Those listed are chiefly in the basic steam pressure classes — 150 to 2500 lb — and include globe and angle, gage, instrument, hydraulic and relief types, also strainers, and check, gate, non-return and blow-off valves. Edward Valves, Inc. *(See ad on pages 44–45.)*

206 Gate Valves — Literature is available on cast steel outside-stem-and-yoke gate valves; also on bronze, iron, steel and corrosion-resisting valves in many types. The Wm. Powell Co. *(See ad on page 43.)*

207 Blow-off Valves — Illustrated Bulletin B-433, 24 pp, describes blow-off valves for high-pressure boilers, and covers seatless, hard-seat and unit-tandem types, for working steam pressures from 400 to 2500 lb. Construction details and operating principles are illustrated. Dimensions and specifications included. Yarnall-Waring Co. *(See ad on pages 10–11 for information on other blow-off valves.)*

208 To Get at Those Valves — This little folder describes a sprocket rim with chain guide. The rim adjusts to fit all valve wheels. Babbitt Steam Specialty Co. *(See ad on page 138.)*

209 High Pressure Gate Valve — Described in 4-pp Form DH-273 is a forged steel gate valve designed for long service and low cost maintenance. Working pressures, sizes and prices listed. R-P & C Valve Div., American Chain & Cable Co., Inc. *(See ad on page 114.)*

210 Design Properties of Pipe — This 12-pp booklet consists of tables listing pipe sizes and wall thicknesses currently established as standard, plus dimensional properties of commercially available sizes of steel pipe. Tube Turns, Inc. *(See ad on pages 19–20.)*

211 Unions and Fittings — Twelve-pp Catalog 50 covers manufacturer's line of unions of all types, elbows, tees and fittings. It describes and illustrates special features. Dart Union Co. *(See ad on page 121.)*

213 Valves, Fittings and Flanges — Catalog F-9 is a 400-pp, permanently bound reference book on drop forged steel valves, fittings and flanges for practically all piping needs at high and low pressures and temperatures. Provides ordering information on company's complete line, also much helpful engineering and application data; includes a section on products for refrigeration service. Henry Vogt Machine Co. *(See ad on page 48.)*

214 Piping Pointers — This is company's highly popular 36-pp manual covering fundamentals of sound piping practices. Discusses various types of valve designs and how each should be used. Pictures and names more than 80 fittings and contains illustrated how-to-do-it features. Includes 8 pp valve selection guide. Crane Co. *(See ad on page 61 for information on valves.)*

216 Steam, Air and Gasoline Traps — Illustrated Catalog 751, 32 pp, provides capacity tables, installation diagrams and a section containing data, charts and formulas for determining proper size trap for specific applications. Covers thermostatic steam traps for pressures to 225 lb; expansion steam traps for pressures to 250 lb; weight-operated traps for steam, air, gasoline, pressures to 1500 lb; piston-operated steam traps for pressures to 650 lb. W. H. Nicholson & Co. *(See ad on page 136.)*

219 Forged Fittings — Literature is available on screw-end and socket-weld fittings. Stresses economy and other advantages of these fittings, lists steels available. Watson-Stillman. *(See ad on page 14.)*

220 Duplex Strainer — This literature describes company's Duplex strainer with single handwheel control. Shows how it is designed with only one stuffing box and can be cleaned under full flow. R. S. Products Corp. *(See ad on page 131.)*

PUMPS AND COMPRESSORS

223 Compressor Selection Chart — Based on normal applications handling air with atmospheric intake pressure, this chart simplifies selection of proper size compressor, giving quick comparison between discharge pressure pounds per square inch gage and piston displacement cubic feet per minute. Shows recommended compressor bore and stroke in inches. Worthington Corp. *(See ads on pages 30–32.)*

224 Boiler Feed Pump — A barrel-type boiler feed pump for high pressure, high temperature service and designed to go on the line quickly without preliminary warm-up, is the subject of 12-pp Bulletin 1525. Fully illustrated text explains automatic operation of hydraulic thrust balance incorporated in this pump. De Laval Steam Turbine Co. *(See ad on page 56.)*

225 Rotary Compressors — Bulletin C-1 is company's most recent on rotary compressors. Fully illustrated, provides sketches of intake regulator, and bearing and ring assemblies, also photos of installations. Explains operation. Fuller Co. *(See ad on page 120.)*

226 Screw Pumps — Bulletin 8204, 18 pp, describes and illustrates Warren-Quimby screw type rotary pumps. Provides sectional and exterior views, installation pictures, dimensions, engineering and selection data. Warren Steam Pump Co., Inc. *(See ad on page 59.)*

227 Centrifugal Pumps — Twelve-pp Bulletin 715-1 presents manufacturer's support-head type centrifugal pumps, describing and illustrating construction details, and providing performance data, specifications and dimensions. These are single stage, ball bearing, enclosed impeller pumps for direct or belt drive. Goulds Pumps, Inc. *(See ad on page 122.)*

PACKINGS, GASKETS, SEALS

228 Manual on Packings — Containing 84 pp of engineering and ordering information, Catalog 40 covers packings for practically every service. Includes packaging recommendation charts, conversion tables. The Belmont Packing & Rubber Co. *(See ad on page 140.)*

229 Packings and Gaskets — Catalog P-100C, 32 pp, covers 95 most popular packings and gaskets in company's line, furnishing details of construction, service recommendations and size information. Includes charts showing specific recommendations for a wide variety of applications. Packing Div., Raybestos-Manhattan, Inc. *(See ad on page 21.)*

230 Packings for the Power Plant — Designed as a quick-reference aid, one feature of this compact 6-pp guide is a flow sheet of a rudimentary industrial power plant with each unit keyed to the proper packings and gaskets. These, in turn, are illustrated with close-up photos and construction information, sizes, etc. Packings and gaskets are grouped on the pages according to recommended applications. Johns-Manville. *(See ad on page 144.)*

BOILERS AND AUXILIARIES

232 Shop-Assembled Boiler — Eight-pp Bulletin G-72 introduces company's new integral furnace boiler. Describes and illustrates its economy, ease of installation and connection, flexibility, minimum space requirements, efficient combustion, fast steaming. The Babcock & Wilcox Co. *(See ad on pages 24–25 for information on larger boiler installations.)*

234 Re-Circulation Steam Generator — Here's a 6-pp folder on a controlled re-circulation steam generator, describing its development and uses, such as applications where steam is required in remote locations, where demands are intermittent, or load fluctuating. Combustion Engineering-Superheater, Inc. *(See ad on pages 12–13 for information on vertical unit boilers.)*

235 Steam Boilers — Form SG 128–749 is a 12 pp catalog illustrated with photos of steam boilers for processing and heating, ranging from 15 to 500 hp and 15 to 200 psi. Includes diagrammatic cross-section of four-pass design characteristic of manufacturer's boilers. Cleaver-Brooks Co. *(See ad on page 29.)*

236 Packaged Generators — Bulletin SB-38 presents company's Keystone model. Photos and sketches show complete unit, pressure element and details of its compact design. Gives advantages of two-drum water boiler, three-pass gas travel, automatic gas or oil burner. Erie City Iron Works. *(See ad on page 54.)*

237 Gage Glasses — This folder describes company's Sonderglass boiler gage glasses available in clear or reflecting types. Tells merits of these handmade glasses, stressing strength of double-layer construction. Includes prices. A. W. Chesterton Co. *(See ad on page 118.)*

WHY INSULATE YOUR CONDENSER TUBES?

You may be doing just that if your plans don't include CHLORINATION EQUIPMENT for slime control by WALLACE & TIERNAN.

Chlorination equipment because it controls slime that *grows* on the walls of condenser tubes not protected against it. Enough of the growth eventually seriously reduces heat transfer efficiency — actually *insulates* your steam from the cooling water. Back pressures go up, production drops, operating and maintenance costs rise, and eventual shut-down becomes necessary for regular clean-out periods.

Wallace & Tiernan equipment because it is versatile, sturdy and dependable — proven by thousands of successful installations, vouched for by satisfied users everywhere-and because there's a Wallace & Tiernan chlorinator for every job. Write today for information on how Wallace & Tiernan chlorination may help you solve *your* slime problem.

NO WATER IS SLIME-FREE regardless of the source. Chlorination helps reduce slime in make-up or cooling water.

CD-37

WALLACE & TIERNAN COMPANY, INC.

CHLORINE AND CHEMICAL CONTROL EQUIPMENT

NEWARK 1, NEW JERSEY • REPRESENTED IN PRINCIPAL CITIES

238 Dowtherm Vaporizer — Bulletin No. 48-2, describing manufacturer's Type "A" Dowtherm Vaporizer, tells how this unit is designed to evaporate Dowtherm to provide dependable operation at maximum temperatures. The Wickes Boiler Co. (*See ad on page 116 for information on boilers.*)

TUBING

239 Double-Walled Tubing — Technical Bulletin 1950, 12 pp, presents tubing designed for conditions where single-walled tube can't withstand simultaneous attack from two types of corrosive media. Describes and illustrates construction, illustrating possible metal combinations. Explains tubing's use in ammonia refrigeration, boilers, steam generators and other applications. Bridgeport Brass Co. (*See ad on page 139.*)

240 Life Extension for Condenser Tubes — This 32-pp extensively illustrated booklet reports on research into the causes of corrosion and means of combating them, as well as the choice of condenser tube materials. Points out that Admiralty metal, long a standard for power plant condenser tubes, works satisfactorily in most installations, but other alloys may be necessary in some circumstances. Revere Copper and Brass, Inc. (*See ad on page 28.*)

241 Nickel Pipe and Tubes — Bulletin T-17 is a 27-pp technical bulletin on the fabrication and design of nickel and high nickel alloy pipe and tubing, illustrated throughout by drawings and photos. Presents tables on mechanical and physical properties, ASME code requirements, recommended welding procedures. The International Nickel Co., Inc. (*See ad on page 104 for information on Monel.*)

242 Condenser Tubes — Excellent factual information on condenser tubes and their service life is given in this 40-pp illustrated booklet. Subjects discussed include corrosion of condenser and heat exchanger tubes, corrosion resistance and control, the selection of tube materials, and the composition and physical properties of company's alloys. Scovill Mfg. Co. (*See ad on page 124.*)

FUEL OILS, LUBRICANTS

243 Cooperative Technical Consultation Service — This informative 24-pp booklet presents company's periodic consultation service aimed at the most efficient use of petroleum products. Covers services available in the solution of lubrication problems, metalworking operations, processing, fuel and heating oils, and also dust control. Gulf Oil Corp., Gulf Refining Co. (*See ad on page 108 for information on turbine lubricants.*)

244 Lithium Soap Greases — Twelve-pp Booklet AD3084, on manufacturer's Stanolith greases, explains how they withstand both high temperatures and wet operating conditions. Discusses two grades — one recommended for central dispensing systems, and a heavier grade for compression cups or pressure gun applications. Standard Oil Co. (Ind.) (*See ad on page 58 for information on a multi-purpose oil.*)

245 Air Compressor Lubrication Manual — Valuable information on air compressor maintenance is contained in this 40-pp book. Subjects treated include compressed air, compressors and related equipment, lubricating systems, compressor oils and applications, lubrication requirements, operating hints, oil requirements, storage and care of compressor oils, safety. Cities Service Oil Co. (*See ad on page 63 for information on combustion efficiency.*)

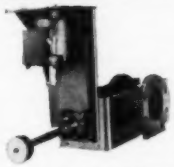
246 Lubrication of Diesel Engines — An excellent instruction manual, 50-pp Technical Bulletin B-1 (revised) also provides a brief history on diesel engines, an explanation of the fundamentals of design and the common types of diesels and their advantages. Explains combustion process, discusses modern fuel injection systems. Cylinder and bearing lubrication are treated in detail and recommendations given for lubricating oils. Sun Oil Co. (*See ad on page 9 for information in lubrication of refrigeration systems.*)

R-S valvEvents

• EXCERPTS FROM THE R-S BOOK OF EXPERIENCE •

WATER SERVICE—No. 825—36-inch 125-pound cast iron valve equipped with 18—8 shafts, bronze bushings and rubber seat for 85-pound drip tight shut-off.

EMERGENCY OIL SERVICE—No. 628—solenoid trip valve. Should the solenoid function, the latch is tripped which causes the counter-weight to open or close the valve by gravity. Available in any metal or alloy and in various sizes for emergency shut-off or vent for air, gas, steam, oil, and water.



700° F. EXHAUST GAS SERVICE—No. 826—6-inch 125-pound R-S "H" metal valve used on small turbine generator. Equipped with 18—8 shafts, hastelloy bushings, finned lubricated stuffing box and solenoid trip mechanism.

STEAM SERVICE—No. 677—1500-pound welding end steel valve for superheated steam—A. S. M. E. Standards.

SEMI-SOLID SERVICE including abrasive and corrosive materials.

R-S VALVES

Control and Shut Off Practically Any Material

The beveled vane seats firmly at a 12½° angle and is closed from a fully open position through 77½° of arc by either manual or automatic operation. A metal-to-metal seat gives satisfactory commercial shut-off. When required, Monel or stainless steel can be welded to the vane periphery and a babbitted seat used in the valve body. Drip tight or bubble tight closure can be obtained with a rubber seat.

Power controlled prime movers delivering the necessary foot pounds of torque open or close these self-cleaning valves at any desired speed from one second to eight minutes according to requirements. Pressures range from 2 to 2500 psig and temperatures from minus 300° F. to plus 2000° F.

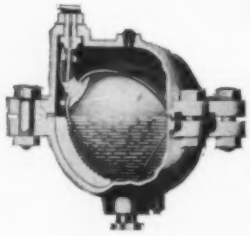
Such simplicity of design, adaptability and operating ease are the reasons why R-S Valves can be installed to control and shut off the volume and pressure of any material that flows or is forced through a pipe.

Obtain full details from your R-S representative.

R-S PRODUCTS CORPORATION
4600 Germantown Avenue, Philadelphia 44, Pa.
An S. Morgan Smith Company Subsidiary

DISTRICT OFFICES IN PRINCIPAL CITIES

GET RID OF AIR ACCUMULATIONS IN PIPE LINES...



a BIG Trouble Saver that Costs You LITTLE!

When air lodges at high spots in pipe lines, it reduces the effective area of the pipe, creates a friction head, lowers pumping capacity, and may result in serious water hammer!

Simplex Air Release Valves bring you a sure, efficient cure for these difficulties . . . venting air *automatically before it can cause damage.*

The Simplex Air Valve is easily installed . . . positive in action . . . ample in capacity. Standard valves for pressures up to 250 p.s.i. . . . special valves for pressures up to 800 p.s.i. Thousands have been in successful use for over 30 years.

IT'S SIMPLEX IT'S ACCURATE

Write for free bulletin to Simplex Valve & Meter Co., Dept. 5, 6783 Upland Street, Philadelphia 42, Pa.

SIMPLEX
VALVE AND METER COMPANY

NEW HEAT SAVING EFFICIENCY

- *Longer Life*
- *Custom Molded Precision Pipe Fit*
- *Attractive, Smooth Finish*

Now available in pipe covering and block insulation, Mundet 85% Magnesia permits new heat-saving efficiency. Precision manufacturing on the latest type of automatic equipment insures uniform standards. Extra durability is built into the insulation. It does not "powder", settle or disintegrate. It is unaffected by either steam or water leakage. It maintains an attractive, smooth finish. Precision pipe fit is assured, with no spaces left for the escape of heat. You benefit from the most modern manufacturing facilities for the production of heat insulation. Write for specification information and recommendations. Mundet Cork Corporation, Insulation Division, 7115 Tonnelle Avenue, North Bergen, N. J.

MUNDET

MUNDET

247 Clean Oil for Diesels — A combination purifying and filtering unit utilizing centrifugal force and controlled filtration is the subject of illustrated Bulletin DL-1. Explains operation of the unit, tells advantages. The DeLaval Separator Co. (*See ad on page 111.*)

248 Diesels, Their Fuels and Lubricants — This 46-pp book gives practical information on diesel engines, covering their history and economics as well as design characteristics and operating principles. Classification of diesels according to speed is explained. Sinclair Refining Co. (*See ad on pages 52 and 53.*)

249 Viscosity of Fluids — The larger significance of viscosity is discussed in Nos. 5 and 6, Vol. 36 of Lubrication, a technical publication. In six parts, the first illustrates simplest conception of streamline flow between two surfaces having relative motion. A series of torsion viscometers shows how viscosity acts and may be measured. Part II covers streamline flow in capillary and other small tubes. Part III covers turbulent flow in pipes. Part IV discusses effects of temperature and pressure on viscosity, and Part V includes viscosity index. Part VI gives brief reference to nature of plastic flow. The Texas Co. (*See add on back cover for information on diesel lubricants.*)

INSTRUMENTS AND CONTROLS

252 Composite Catalog — Illustrated Catalog 5000, 28 pp, describes principal instruments, control devices and related components manufactured by company's industrial division. Specifications of 100 measuring and control instruments, and valves are outlined. Brown Instruments Div., Minneapolis-Honeywell Regulator Co. (*See ad on pages 34–35 for information on temperature monitoring instrument.*)

253 Temperature Regulators — Twelve-pp Bulletin T, Catalog 80, describes manufacturer's line of regulators for controlling temperature of liquids and gases, giving their applications, operating characteristics, construction specifications, dimensions. Foster Engineering Co. (*See ad on page 117.*)

254 Easy Reading Gage — An all-hydrostatic remote reading gage for boiler water and other liquid levels is described in Catalog 500, Section CO. Pictures improved visibility, other advantages offered by this gage, explains operation. The Reliance Gauge Column Co. (*See ad on page 125.*)

255 For Combining Control Signals — The improved design of company's Ratio Totalizer is described and pictured in color in 8-pp Bulletin 5452. This simplified versatile mechanism is a pneumatically operated control for combining input control pressures and spring forces, and producing an output control pressure based on addition, subtraction, multiplication, division or more complicated functions. Hagan Corp. (*See ad on page 55.*)

256 Control Equipment — Catalog 001, 30 pp, is on measuring and control equipment for water and sewage works, power and processing industries. Describes venturi tubes and meters, controllers, gages, manometers, pilots. Simplex Valve and Meter Co. (*See ad on page 132 for information on air release valves.*)

257 Temperature Instruments — This catalog gives full details about company's complete line of industrial glass, dial and recording thermometers, electronic temperature indicators and recorders. Fully illustrated, includes application information. American Industrial Instruments, Manning, Maxwell & Moore, Inc. (*See ad on page 18.*)

258 For Centralized Control — Bulletin 109 presents compact Mini-Line equipment suited to control board arrangement which concentrates vital operating information and controls for one or more boilers, turbines or process units before a single operator. Bailey Meter Co. (*See ad on page 115 for information on other control equipment.*)

FANS, BLOWERS

261 Mechanical Draft Fans — Mechanical draft fans for both forced and induced draft service are described in 20-pp Bulletin 168. Illustrated with drawings of typical fan types and photos of installations, includes performance curves showing efficiencies of various types of fans. Gives construction features, drive arrangements. The Green Fuel Economizer Co., Inc. (*See ad on page 134.*)

262 Axial Flow Blowers — In this 6-pp illustrated bulletin are described axial flow blowers of both turbine-driven and motor-driven types. Gives capacity and dimensional data, operating range and specifications on both types. L. J. Wing Mfg. Co. (*See ad on page 135.*)

TOOLS

263 Pipe Tool Book — This is the latest edition of company's catalog and data book giving information on pipe and bolt machines, power units, ratchet threaders, reamers and cutters, other power and hand tools. Includes popular "operating guide" section. Fully illustrated. Beaver Pipe Tools. (*See ad on page 138.*)

264 Rotary Tube Cleaners — Bulletin R-105 presents air and water driven rotary tube cleaners and cleaner accessories. Illustrates several models and heads, discussing special features. Roto Div., Elliott Co. (*See ad on page 126.*)

COAL, ASH HANDLING

266 Where Refuse Is Fuel — Presented in 24-pp Bulletin are installations of company's RotoGrate stokers with medium-size and larger units burning refuse fuels, separately or in combination with coal. Lists many of the refuse fuels handled successfully by this type of spreader stoker. More than 20 such installations are described, illustrated. Detroit Stoker Co. (*See ad on pages 112–113 for information on stokers for wartime coal.*)

267 Why Liquid Diffusion — What liquid diffusion can do for power plants is explained in Form B, which tells how liquid diffusion compounds work and gives four practical applications. These include dust control in coal handling, fly ash control, coal storage pile treatment and boiler cleaning. Johnson-March Corp. (*See ad on page 135.*)

268 Coal Handling Equipment — Modern equipment for the storage and handling of coal and ash is presented in 24-pp Bulletin 300. Illustrated, covers concrete and tile silos, cylindrical steel tanks, suspended steel bunkers. Gifford-Wood Co. (*See ad on page 42.*)

269 Economic Coal Storage — How tractors establish safe, orderly coal handling is told in this 8-pp booklet. Stresses flexibility, low operating costs. Also shows how tractors speed storage reclamation and how a tractor-scraper combination offers plus benefits. Illustrated with action photos; pictures several models. Tractor Div., Allis-Chalmers Mfg. Co. (*See ad on page 50*).

REFRACTORIES, INSULATION

270 Incombustible Material — "The Story of Kaylo," 24 pp, describes company's new basic material, an hydrous calcium silicate product, covering some of the many uses for this incombustible material in construction and industrial fields. Tells how product was developed, describes its properties, tells densities available for thermal, insulating uses. Kaylo Div., Owens-Illinois Glass Co. (*See ad on page 67.*)

271 Industrial Insulations — Selection and application information on insulating materials is presented in this 28-pp illustrated catalog. Covers block and blanket insulations, insulating cement, low pressure coverings, felt, other products. Gives specifications, temperature ranges, recommended thicknesses, prices. Baldwin-Hill Co. (*See ad on page 138.*)

Steam
plus
CORAVOL
(The Original* AMINE PROCESS)
equals
Protection (FROM CORROSION)

Because CORAVOL Circulates to Control Corrosion

CORAVOL circulating throughout your steam system protects it from corrosive attack. **CORAVOL** saves costly pipe repairs and replacements — maintenance labor — hours and days of shutdown loss. **CORAVOL** cleans out clogging rust deposits, improving heat transfer, restoring original capacity of lines and efficiency of valves and traps.

CORAVOL, the original* amine process, has the flexibility that lets it conform to each individual need. The **CORAVOL** *you* will use is formulated to do the best protective job under your own plant conditions.

CORAVOL IS PART OF A COMPLETE TECHNICAL SERVICE which provides special chemical formulas for: boiler feed water . . . foam prevention . . . hot water supply . . . refrigerating brine . . . cooling and condenser water . . . rapid scale removal . . . coagulation . . . algae control . . . fuel oil supply . . . soot removal.

*The use of **CORAVOL** in steam systems is covered by U. S. Patent No. 2053024. The Western Chemical Co., owner of this patent, grants licenses under which volatile AMINES purchased from other sources may be used in steam systems upon payment of royalty to Western Chemical Co.

Chemical Water Treatment

WESTERN CHEMICAL COMPANY

717 Washington Street
Kansas City 6, Missouri

MAIL COUPON TODAY for
Complete Data about the CORAVOL Process
Western Chemical Company,
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Kansas City 6, Missouri
Send me full information about CORAVOL.

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GREEN FANS . . . Used by Many Leading Utilities

One significant fact about Green Fan Installations at the New Orleans Public Service Plant is that two different boiler manufacturers were involved . . . two different types of boilers but Green Draft Fans for all three boilers. Each boiler has two Green Induced Draft Fans and one Green Forced Draft Fan.

When a concern has specialized on an important piece of power plant equipment for many years, that firm is rightly called the "authority" on the subject. This is the position of Green Fuel Economizer Co. in the field of mechanical draft fans. The name Green is synonymous with Draft Fans highly acceptable to industry.

The Line of Green Induced and Forced Draft Fans includes many types in many sizes which are described in Bulletin No. 168. We shall be glad to discuss your fan requirements with your own engineers, with your consulting engineers and with the boiler manufacturer of your choice.

THE GREEN *Fuel Economizer* COMPANY INC.

BEACON 3, NEW YORK

ECONOMIZERS • FANS • AIR HEATERS • CINDERTRAPS

272 Heat Insulation Data — This is a 12-pp illustrated engineering and specification manual describing applications for 85 per cent Magnesia heat insulation. Provides data on heat savings per pipe thickness, for heat ranges to 600 F. Includes charts for determining thickness standards for pipe covering, with tables for heat calculations. Mundet Cork Corp. *(See ad on page 132.)*

WATER CONDITIONING

273 Water Conditioning Information — Here are three informational bulletins. No. 28X7446 describes a simple way to determine total hardness in water, illustrating procedure. No. 28X7559 gives an analysis of the hot process-hot zeolite system telling results to be expected. No. 28X7466 discusses current status of embrittlement in boilers. List bulletins wanted. Allis-Chalmers Mfg. Co. *(See ad on page 105 for information on alkalinity-reducing ion exchanges.)*

274 Chlorination for Power Plants — Form RA-2061-C is a 20-pp technical article, "Recent Developments in Chlorination and Equipment for Power Plants." Discusses such subjects as industrial water chlorination, the desliming processes, air pilot chlorinator operation, organic slimes and scales, chlorine ammonia reactions, chlorine residual recording. Illustrated with photos of equipment, charts. Wallace & Tiernan Products, Inc. *(See ad on page 130.)*

275 Water Treatment — Bulletin 5000, 24 pp, explains the reasons for boiler water treatment and tells services offered by company in providing formulations for individual plant requirements. Covers pre-treatment, internal treatment, treatment application, blowdown adjustment, test control. Describes available equipment and includes reference bibliography. Dearborn Chemical Co. *(See ad on page 65 for information on return line corrosion.)*

278 Carryover Prevention — Eight-pp Technical Paper 115 discusses the role of anti-foam agents in the prevention of carryover of boiler water solids with steam. Fully illustrated, covers mechanical and chemical influences on carryover, foaming and anti-foam action, types of anti-foam agents. W. H. & L. D. Betz. *(See ad on page 103 for information on organic agents.)*

279 What's New on Ion Exchangers — Here are three booklets covering company's ion exchangers: Nalcite HCR, a styrene type cation exchanger; Nalcite SAR, a strongly basic anion exchanger; and Super Nalcolite, a synthetic gel type zeolite for cation exchange. Tables and graphs explain performance of these water treating resins under various operating conditions. Physical characteristics, exchange capacities, regeneration techniques discussed. Bulletin 57, 20 pp, is on Nalcite SAR; Bulletin 58, 28 pp, Nalcite HCR; Bulletin 59, 8 pp, Super Nalcolite. State those wanted. National Aluminate Corp. *(See ad on page 36.)*

282 Water Conditioning Bulletin — This is an 8-pp discussion of water and the chemicals developed for conditioning it to control scale and algae and inhibit corrosion. Describes several chemicals in detail, giving properties, composition. Wright Chemical Corp. *(See ad on page 132.)*

283 Zeolite Water Softeners — Publication 4530, 16 pp, presents hydrogen zeolite (cation exchange) water softening equipment. Gives complete description of the process and the field of application, showing advantage of hydrogen zeolite softening and its relation to sodium zeolite softening process. Cochrane Corp. *(See ad on page 119.)*

284 Feedwater Treatment — Here is a 10-pp illustrated report on boiler feedwater treatment for a high-pressure, high-makeup power and steam producing plant. It is based on studies to determine best method of meeting requirements for both the high-pressure steam used in power generating turbines and the district heating steam for downtown Philadelphia. Reasons for deciding on a demineralizing plant are given. Graver Water Conditioning Co. *(See ad*

COAL DUST STOPPED!

at 1/10 the usual cost

BEFORE

Dust conditions as they exist at a car dumper in a large mid-west utility when the Johnson-March System is turned off. Compare this untouched photo with the one below.

AFTER

With the Johnson-March System in operation. Note how the absence of dust in this photo permits the sunlight to stream in from above. The J-M System stops dust at the source.

In this large public utility, a Johnson-March Dust Control System controls dust as no other system can control it. For unlike systems employing expensive ducts, fans and other cumbersome equipment, the J-M System *stops dust at the source—not after the dust has become airborne!*

The cost to this utility for positive dust control averages less than 1/10 the cost of other methods.

Hundreds of J-M installations are daily controlling the worst possible dust conditions. Former critical dust centers such as car dumpers, hoppers, crushers, belt galleries and coal piles are no longer the hazards they once were—possible sources of coal dust explosions or spontaneous combustion.

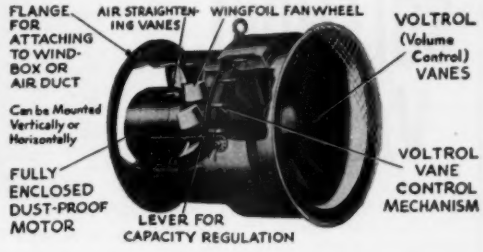
Our engineers will be glad to discuss your dust problems at no obligation. Write today for detailed information.

Johnson March

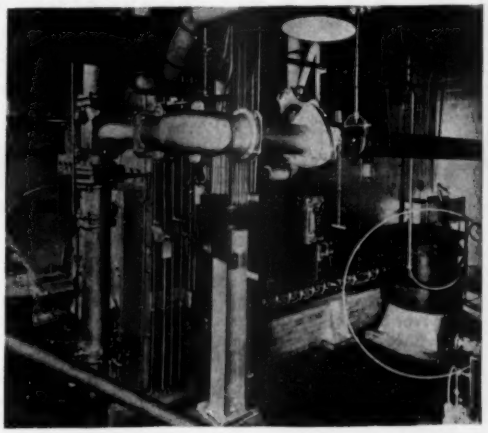
Specialists in Dust Control

Dept. PE-2 • 1724 CHESTNUT STREET • Phila. 3, Pa.

COMPACTNESS, EASE OF REGULATION, LOW MAINTENANCE—IN THE WING FORCED DRAFT BLOWER


FLANGE FOR ATTACHING TO WIND-BOX OR AIR DUCT
AIR STRAIGHTENING VANES
WINGFOIL FAN WHEEL
VOLTROL (Volume Control) VANES
Can be Mounted Vertically or Horizontally
VOLTROL VANE CONTROL MECHANISM
FULLY ENCLOSED DUST-PROOF MOTOR
LEVER FOR CAPACITY REGULATION

Wing Axial Flow Blowers for over half-a-century have been delivering consistently satisfactory performance in thousands of boiler plants. Today's Wing Blowers with many superior features—such as the Voltrol Vanes for capacity regulation down to 10% at maximum—are to be found as standard equipment on many of the country's leading makes of boilers. Photo shows typical installation on an oil burner windbox. No ducts or extra supports required.



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Offices in Principal Cities of U.S. & Canada

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AXIAL FLOW FORCED DRAFT BLOWERS

SOLENOID VALVES

Built to Handle Tough Jobs!

COMPLETELY SEALED VALVE MECHANISM. Valve stem is packless and sealed by internal diaphragm. Widely favored for handling inflammable or toxic gases or liquids.

SELF-CLEANING DESIGN. Can be used successfully for handling heavy, sticky materials because the valve interior is simple, port area large, and outlet downward, thus taking advantage of natural gravity flow. Note that valve seat is accessible for cleaning.

EXPLOSION-PROOF SOLENOID HOUSING. Isolated coil minimizes heat transfer, baking. Lever action provides power advantages to avoid overloading of solenoid.

RENEWABLE VALVE DISC. Supplied with composition or metal disc to suit particular requirements. Wide choice of materials available for valve and trim.

VISIBLE ACTION. Note that valve action is visible and can be tested by hand. In an emergency the valve can be manually operated.

Ask for recommendations

DAVIS REGULATOR COMPANY
2508 So. Washtenaw Ave., Chicago 18, Ill.

This Plant Claims Their

HEAT SAVINGS PAID for NICHOLSON TRAPS

Nicholson expansion steam traps were installed by a processor on tank heaters and coils where various unit temperatures from 160° to 185°F were to be maintained. The steam temperature was 320°F. Figuring the difference in heat loss between traps discharging condensate at 160° and others discharging it at approximately steam temperature, they feel the loss was cut nearly in half. On this basis Nicholson expansion steam traps are paying for themselves in many industries.

For All Equipment Using Steam or Hot Water

CATALOG 751 OR SEE SWEET'S

Radiators, Separators, Paper Machinery, Pipe Coils, Kettles, Railway Coaches, Dry Kilns, Vulcanizers, Switch Heaters, Laundries, Molding Presses

160 Oregon St., Wilkes-Barre, Pa.

W. H. NICHOLSON & CO.
TRAPS · VALVES · FLOATS

on page 68 for information on another softener installation.)

285 Boiler Water Manual — Factual information on methods of applying chemicals in treatment of water for boilers is presented in 16-pp Standard Method 122. Discusses pretreatment of raw water, application of chemical feeding to pretreating operations and both constant rate and flow responsive feeding direct to boiler drum and to feed-water system, condensate returns, % Proportioneers, Inc. % *(See ad on page 6 for information on a chemical feed pump.)*

286 Corrosion Treatment — "Corrosion Protection of Steam and Condensate Return Systems" is a folder on amine treatment for boiler and condensate systems. This treatment is described as affording surface protection of the metal as well as raising pH value of condensate. The Bird-Archer Co. *(See ad on page 109.)*

287 Chemical Treatment of Water — Bulletins describing various methods of chemical water treatment, including company's Coravol process, are available. Coravol is part of a complete technical service which provides special chemical formulas for boiler feed water, foam prevention, hot water supply, refrigerating brine. Western Chemical Co. *(See ad on page 133.)*

288 One-Minute Water Tests — Rapid, simple and accurate tests for determining water hardness are described in Bulletin 1RE50. Procedures, reagents, and equipment are described. Hall Laboratories, Inc. *(See ad on page 106.)*

OTHER EQUIPMENT

289 Air Preheaters — Illustrated Bulletin A-11610, 8 pp, defines air preheat and explains its benefits in terms of increased efficiency and capacity and flame stability. Provides general description of company's Ljungstrom preheater, discusses its use in boiler plants. The Air Preheater Corp. *(See ad on page 69.)*

290 Transmission Belting — Catalog M-9922, 28 pp, gives design, engineering and performance data on transmission belting. Tables on belt speeds, arc of contact, friction, horsepower correction, and service. United States Rubber Co. *(See ad on page 49 for information on friction tape.)*

291 Cooling Towers — Bulletin AQ-50 is on packaged water cooling towers in 3 to 50 t sizes. Gives specifications for the tower and discusses special features. Also provides dimensional and application data. The Marley Co., Inc. *(See ad on page 110.)*

292 Refrigerant Gas Purgers — How air and other non-condensables get into refrigeration systems, adverse effect of this on operating costs and efficiency, and how company's forged steel purger works to prevent this are covered in 8-pp Bulletin 192. Includes installation data, specifications and prices. Armstrong Machine Works. *(See ad on page 4 for information on steam traps.)*

293 Turbine Generators — Bulletin H-18, 40 pp, covers turbine-generators of 500 kw and above, pictures nearly 50 turbine-generator installations, both utility and industrial. Brief discussions of generator and exciter cooling methods are included. A reference section offers detailed drawings showing a typical turbine condenser installation arrangement. Elliott Co. *(See ad on pages 2–3 for information on turbochargers.)*

294 Gas Burners — Illustrated Bulletin 410–8, 16 pp, furnishes descriptive and technical data on company's gas burners and combination gas and oil burners, giving design details and explaining operation of each type. Coppus Engineering Corp. *(See ad on pages 26–27.)*

295 Plus Protection — Vol. 2, No. 2 of the Magnesium Anode is a 2-pp discussion of the value of supplemental cathodic protection for coated pipelines, using magnesium anodes as the source of current. Dowell, Inc. *(See ad on page 39 for information on cleaning a turbo-condenser.)*

Have you a fly ash recovery problem?

Bring it to
WESTERN PRECIPITATION

. . . The Only Organization With Years Of "Know-How" In BOTH *Electrical* And *Mechanical* Recovery Methods!

If you have any kind of a suspension-recovery problem—whether dust, fly ash, fume, fog or mists—it will pay you to bring it to the leading organization in the field . . . WESTERN PRECIPITATION CORPORATION. Western Precipitation not only pioneered, over 44 years ago, the first commercial application of the now-famous COTTRELL Electrical Precipitators, but also has been a leader for many years in the *mechanical* recovery field with its widely-accepted MULTICLONE Collectors.

Result:

Western Precipitation is unsurpassed in the all-important factor of "know-how" in BOTH the electrical and mechanical fields . . . knows from years of first-hand experience whether your particular problem can best be solved by mechanical or electrical methods—*or by a combination of the two* . . . can give you a direct and unbiased recommendation on the matter . . . and then can provide the complete installation under *one* responsibility, *one* overall performance guarantee, even where Combination Multiclone-Precipitator (CMP) installations are made!

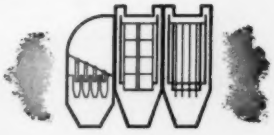
Western Precipitation products and services include . . .

COTTRELL
Electrical Precipitators

. . . the most efficient recovery equipment for high recovery, long life, low maintenance on practically any type of suspensions, wet or dry. COTTRELLS can be designed to handle a few c.f.m. —or millions—with equal ease, and at virtually any operating temperature. Recovery efficiencies closely approach 100% recovery, if desired, with very low draft loss, minimum power costs and negligible labor costs. *By all standards, Western Precipitation COTTRELLS give highest recovery at lowest cost per-year-of-service!*

MULTICLONE
Mechanical Collectors

. . . the most efficient, most compact, most trouble-free mechanical equipment for recovering suspensions from gases. Because of their unique small-tube design, MULTICLONES are unsurpassed in mechanical recovery efficiencies—require less space, less maintenance, and are far simpler to install. No filters or screens to replace, nothing to burn or cause fire hazards, no high speed moving parts to repair or replace. These and many other advantages make MULTICLONE Collectors the logical choice on installations where mechanical recovery is selected.



CMP UNITS
(Combination Multiclone-Precipitator)

. . . combine, in *one* compact installation, both mechanical and electrical recovery principles so that maximum benefit is obtained from the advantages inherent in each method. The MULTICLONE section centrifugally removes the larger and heavier suspensions (down to a few microns in diameter) . . . and the COTTRELL section then electrically removes the very small particles remaining in the gases. Thus, the bulk of the recovery is obtained with relatively low-cost equipment, and the final clean-up is obtained with equipment having unusually high recovery efficiency—approaching theoretically perfect, if desired.

The recovery of suspensions from gases is a highly exact science and every problem is different. Some require mechanical methods—others electrical methods—still others a combination of mechanical and electrical methods in proper balance to meet the individual requirements of each application. No matter what your problem, remember that only Western Precipitation has had years of field experience in BOTH mechanical and electrical methods!

Send for descriptive literature!

Let our experienced engineers study your recovery requirements and make an unbiased recommendation on the equipment best suited to your particular problem. A wire, phone call or letter to our nearest office places this unique "know-how" at your service, without obligation.

WESTERN Precipitation CORPORATION

ENGINEERS, DESIGNERS & MANUFACTURERS OF EQUIPMENT FOR COLLECTION OF SUSPENDED MATERIALS FROM GASES & LIQUIDS

Main Offices: 1029 WEST NINTH STREET, LOS ANGELES 15, CALIFORNIA
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MULTICLONE—T.M. Reg.

Powerhouse Cement is the star performer in the Baldwin-Hill review of *Black* Rockwool insulating materials . . . a quick-drying, low shrinkage *finishing* cement that insulates. Consider these advantages for a leading role in your next plant improvement picture:

- **Effective to 1700°F.**
- **One coat . . . points, seals, insulates**
- **No wire mesh . . . high adhesion to blocks, blankets, or plastic cement**
- **Linear shrinkage less than 1%**
- **Finishes and insulates . . . figure its thickness as part of the insulation**
- **Amphibious . . . withstands a drenching rain two hours after application**
- **Takes oil or water base paint direct**

therm-enomics*

PRESENTS

POWERHOUSE CEMENT

"the Finishing Cement that Insulates"

Popular Powerhouse is only one of a complete line of B-H *Black* Rockwool insulating materials—block, blanket, cements, etc. Let a Baldwin-Hill representative recommend the types and methods of application best suited to your equipment . . . show you how to reduce heat loss on the job—THERM-ENOMICALLY.*

**Economics of Engineered Heat Control*

Baldwin-Hill

8230

IF IT'S TOO HOT TO TOUCH IT NEEDS INSULATION

Black Rockwool

Clip this coupon and attach to your signed letterhead

SEND ME COMPLETE INFORMATION ON:

- ☐ Mono-Block—for temperatures to 1750°F
- ☐ Blankets—metal reinforced, large-area coverage to 1200°F
- ☐ No. 1 Cement—plastic insulation, to 1800°F
- ☐ Powerhouse Cement—high-adhesion finishing to 1700°F

BALDWIN-HILL CO., 907 BREUNIG AVE., TRENTON, N. J.

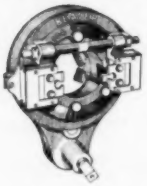
THINKING OF 2½ TO 4-INCH TOOLS?

Here's a Great Team!

For hand or power use

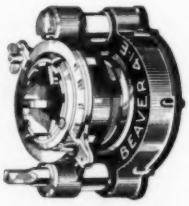
BEAVER 41-E THREADER 104 CUTTER

Beaver No. 104 Geared Square-end Knife Cutter cuts off square and clean without burr. Knives feed automatically — with safety guide ahead of cutting edge to prevent knife breakage. The No. 104 is ideal for cutting, grooving or beveling pipe. Furnished complete with operating ratchet.



No. 104

Beaver No. 41-E Geared Threader is fully adjustable for undersize and oversize threads of uniform length. Threads all sizes, 2½" to 4", with one set of dies! Fully-enclosed gear case! Furnished complete with operating ratchet.

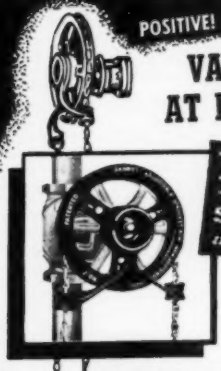


No. 41-E

BEAVER PIPE TOOLS, INC.
274-300 DANA AVENUE
WARREN, OHIO · U. S. A.
"50 Years of Friendly Service"

POSITIVE! EFFICIENT! SAFER!

VALVE CONTROL AT LOWEST COST!



Babbitt *Adjustable* SPROCKET RIM *with Chain Guide*

INSTALLED, AND OPERATING, IN ONLY A FEW MINUTES

● Here's easy, convenient, instant control of overhead, out-of-reach valves—right from the floor! No expensive apparatus! No switches! Nothing to break down when most needed! BABBITT Adjustable Sprocket Rim with Chain Guide, with only four simple parts, gives you positive efficient valve control at lowest cost!

● Prevents accidents, prevents waste, provides efficient control, and saves money. A range of 10 ADJUSTABLE sizes fits all valve wheels with rising or non-rising stems, from 2 to 30 inches in diameter.

Distributors in Principal Cities, or send for Catalog Folder PE-2 and name of nearest distributor.

BABBITT STEAM SPECIALTY CO.
1 Babbitt Square
NEW BEDFORD, MASSACHUSETTS

BRIDGEPORT BRASS COMPANY
CONDENSER AND HEAT EXCHANGER TUBE EDITION
COPPER ALLOY BULLETIN
"Bridgeport" BRASS CO. MILLS IN BRIDGEPORT, CONN. AND INDIANAPOLIS, IND.—IN CANADA: NORANDA COPPER AND BRASS LIMITED, MONTREAL

Reducing Galvanic Corrosion Attack in Sea Water

When two dissimilar metals are brought into electrical contact in an electrolyte, corrosion of the less noble metal (anode) occurs in excess of its normal rates in that electrolyte while the more noble metal (cathode) is protected. This accelerated corrosion is known as galvanic corrosion.

Galvanic action does not occur when dry dissimilar metals are in contact. It is for this reason that iron hangers can be used to support copper and brass pipe. Also numerous mechanical devices made of several dissimilar metals may be successfully used in the absence of water.

Galvanic Corrosion in Salt Water

Solutions of chloride salts are recognized as being very corrosive towards the common metals and alloys and are found in (1) sea water; (2) salt refining; (3) in the manufacture of chlorine, chemicals, soaps, etc.; (4) cooling brines; (5) vegetable sorting brines; (6) crude oil and petroleum products and in numerous other places. Since salt water is so widely used in industrial operations, galvanic corrosion is commonplace because most equipment is generally constructed from many dissimilar metals and alloys.

Galvanic Series Varies With Corrosive Environment

Information obtained on a group of metals, examined under a given set of conditions makes it possible to arrange the metals in a galvanic series.

The following table, showing the differences in behavior of eleven metals in sea water as compared with the Electromotive Series, was obtained by arranging these metals according to their potentials in solutions of their own ions.

Galvanic Series in Sea Water	Electromotive Series
Magnesium	Magnesium
Zinc	Aluminum
Aluminum	Zinc
Cadmium	Iron
Iron	Cadmium
Lead	Nickel
Tin	Tin
Nickel	Lead
Copper	Copper
Silver	Silver
Gold	Gold

However, they do not always follow the same order as given in the Electromotive Series generally published. The order frequently changes very markedly with the corrosive environment.

Galvanic Protection of Copper-base Alloys

Plates of aluminum-base alloys, both with and without copper-base alloy bolts, were immersed in sea water. Within a few months the aluminum showed very slight general corrosion and more intense corrosion localized around the bolts. A similar test, conducted with zinc plates, gave practically the same results. Prolonging the latter test eventually led to a depth of attack sufficient to allow the copper alloy bolts to drop out of the zinc plates. In both instances the copper-base alloys remained intact and showed no signs of corrosion because they had been galvanically protected at the expense of the less noble metals.

Cathodic or Galvanic Protection

Numerous investigations have shown that cathodic protection of metals is feasible. In practice this is accomplished, for example, by the sacrificial protection of iron by zinc, such as galvanized iron (galvanic) or by an imposed potential (cathodic protection) whereby corroding metal is maintained artificially as the cathode. This is applicable only to certain types of structures such as storage tanks, condenser water boxes and the exterior surfaces of pipe lines. This must be done with caution since certain metals may under some conditions be corroded more rapidly by the alkali which normally forms in the cathodic area.

Satisfactory Galvanic Couples

The extremes in potential differences between various copper-base alloys in sea water and in 3% sodium chloride solutions is small, seldom exceeding 0.2 volts. Consequently copper and various copper alloys can be successfully coupled together in such corrosive media. This explains why they are so widely used in salt water services.

The potential difference between dissimilar metals may be unimportant due to the smallness of the exposed area of the more noble member of the galvanic couple. For example, copper alloy bolts fastened in steel plates immersed in sea water do not necessarily lead to increased corrosion of the steel. In such a galvanic couple, the *initial* potential difference between copper and low carbon steel may range from 0.5 to 0.7 volts. This lack of activity is due to stifling of the cathodic reaction on the relatively small surface of the copper alloy bolt head and nut. The stifling is due primarily to deposition of magnesium and calcium carbonate from the sea water on the cathodic surface (copper alloy). This explains why the widespread use of bronze bolts to fasten steel or cast iron parts in marine services has led to no difficulty from galvanic corrosion.

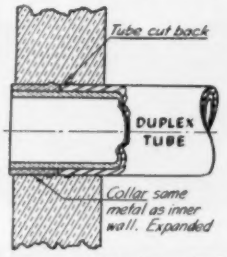


Fig. 1. A common method of protecting Duplex tubing from galvanic corrosion.

Silicon bronze bolts and brazed joints used to fasten together carbon steel sections exposed to sea water have led to no measurable increase in corrosion of the steel because of their small area compared to relatively large carbon steel sections.

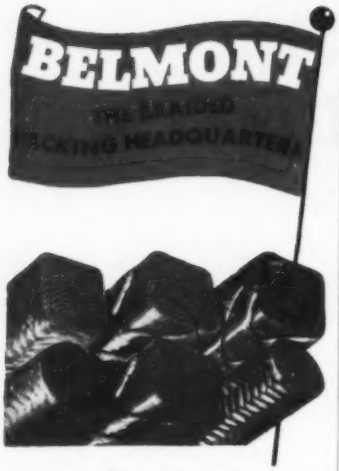
Protecting Duplex Tubing

Since Duplex tubes are often made from a combination of steel or aluminum with copper or a copper-base alloy, the problem of galvanic attack between the two different metals, in certain corrosive environments, can be solved in several ways.

Where it is necessary to prevent galvanic action at the tube sheet, a ferrule of the same material as the inside of the Duplex tube is used. One method is shown in Fig. 1.

Consult the Bridgeport Corrosion Laboratory for assistance with your galvanic corrosion problems on condenser and heat exchanger tubing for power refining or process industries.

(8406)



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Belmont braided packings are described and picturized in catalog No. 40. The type of braid is dependent upon the service conditions, and the materials used are asbestos, flax, cotton, jute, ramie, teflon and metals, lubricated for the purposes intended. Write on your company letterhead for details today.

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"Bucking" shafts throw me!

Packings are for sealing only. Trying to compensate for shaft misalignment or vibration by overpacking and excessive gland pressure results in scored shafts and ruined packing. Think of a stuffing box as a potential brake assembly that may develop considerable frictional resistance with attendant heat and wear.

Worn shafts wear me down

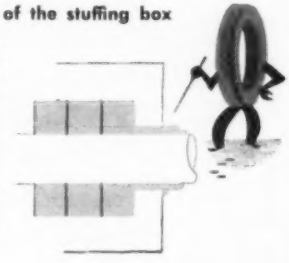
Trying to make packing compensate for excessive shaft or rod wear will shorten packing life materially without alleviating the undesirable condition. Pack correctly to avoid excessive shaft and rod wear. Replace worn shafts and rods as soon as possible to avoid adding the expense of damaged packings to the cost of parts replacement.

Keep my lantern clear

If the stuffing box is equipped with an oil, grease or water lantern, its purpose is defeated when the lantern ring is omitted or the opening blocked by improperly installed packing or other obstruction. This can deprive the packing of lubrication or cooling and result in premature failure.

Don't let me get out of the stuffing box

If the shaft or rod is badly worn, the packing may be extruded into the system when the gland follower is taken up. Considerable difficulty such as packing getting into valves or traps or contaminating the fluid handled may result. Rebush the stuffing box or use a junk ring to reduce the clearance.



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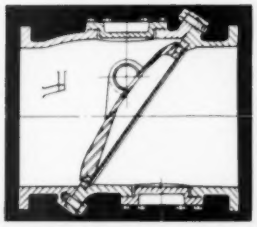

Cross-section of the Chapman Tilting-Disc Check Valve. A feature of the design is that the disc seat lifts away from the body seat when opening, and drops into contact when closing, with no sliding or wearing of the seats.

THE CHAPMAN VALVE MFG. CO.

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